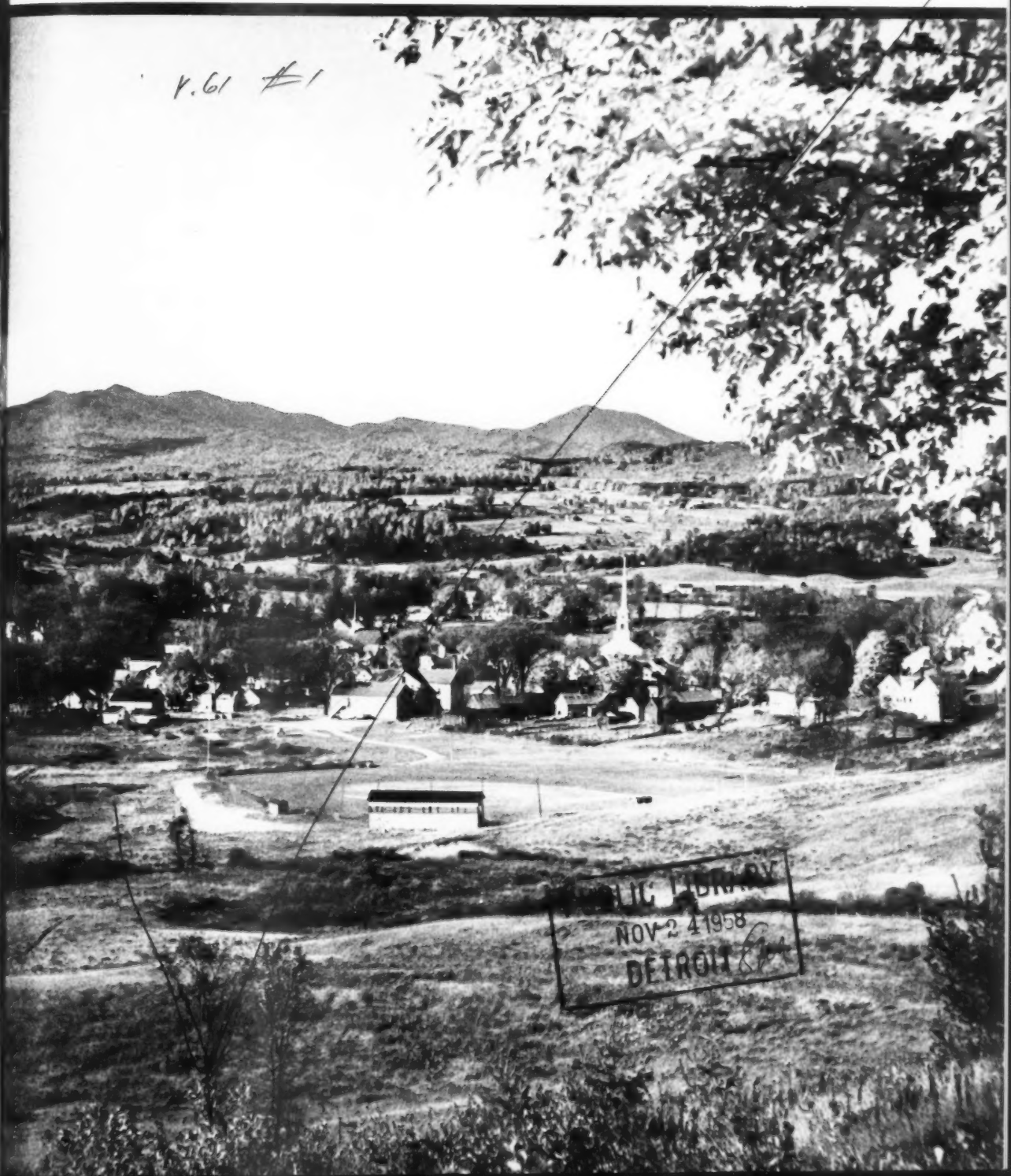
TECHNOLOGY DEPT.

TECHNOLOGY REVIEW

November 1958

V.61 #1



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DETROIT

No. 10 in a series

Right off the Wire

A miniature record player only four by eight inches is capable of playing twelve inch records.

The record of many thousands of electrical installations shows that the use of TIREX cords and cables provides an extra measure of employee safety.

A new process removes helium from natural gas, in which it is a contaminant, by passing the gas through glass pipes, through the walls of which the helium is filtered.

An atomic-powered train has been designed that will travel across country without tracks. It has fifty-two wheels, each of which is electrically driven.

The plastic base of a new electric coffee pot completely encloses and waterproofs both heating element and thermostat.

Titanium alloyed with ranadium, chromium and aluminum makes a new alloy that is said to have the greatest strength for its weight of any structural material.

A complete picture, ready for transmission, is provided by a new transistorized television camera. It weighs only four pounds, including self-contained control and synchronizing units.

A radio telescope over four-hundred feet in diameter is planned for the hills of West Virginia.

Weather information can be transmitted over a thousand-mile range by an automatic radio station which can be dropped anywhere by an airplane.

An automatic electronic inspection machine makes a four-way check of automobile valves at the rate of 3,000 per hour with a tolerance of five millionths of an inch.

An adhesive has been developed that will retain a metal-to-metal bond at temperatures as low as −253 degrees C.

All cords and cables give better service when handled properly. TIREX® portable cords and cables, *although jacketed with fortified and tempered neoprene armor and "lead cured" for toughness and smoothness*, will give still longer service if not subjected tc unreasonable abuse.

By making jet nozzles radioactive and measuring the radiation from the fuel passing through them, the amount of wear can be measured to within one millionth of a gram per hour.

Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.

A miniature battery which is reported to last for five years, uses the radioisotope Prometheum 147. It is suitable for hearing aids, watches or missile guidance systems.

In California, it is proposed to use underground steam to generate electricity as is being done in Italy and New Zealand. Wells are now being drilled and a yield of 100,000 kilowatts is anticipated.

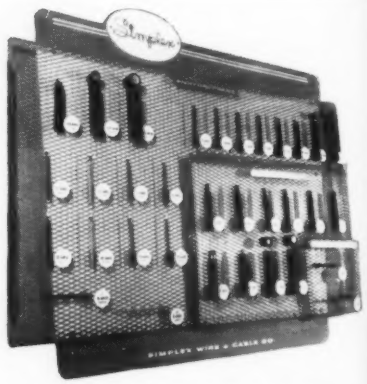
Two radio manufacturers have built extra service into their sets. One warns of approaching tornadoes and the other acts as a radiation detector.

Deuterium, or heavy hydrogen, is concentrated by some bacteria from sea water. This discovery may lead to a new and inexpensive method of producing the heavy water used in reactors.

The area behind the eye that can not be examined by other instruments can now be seen by a device that uses penetrating sound waves and converts their reflection into light.

A disposable medicine container of heat-proof plastic doubles as a hypodermic syringe.

Our atmosphere at an altitude of sixty miles is now known to contain chemicals which could serve as an unlimited fuel supply for ramjet engines.



What's in a name?

The character and business integrity of distributors are measured to a great extent by the products they handle. More than 1000 of the nation's most successful electrical firms — offering the utmost in customer service and satisfaction — recommend and sell Simplex TIREX cords and cables.

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

"The American manufacturers of transoceanic telephone cables"

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A-C Linear Accelerometer, Type LA-600, for aircraft and missiles. Shown actual size.

NEW LINEAR ACCELEROMETER

FEATURES FRICTIONLESS OPERATION

for greater accuracy, ruggedness and reliability

NEGLIGIBLE CROSS COUPLING

A-C VARIABLE RELUCTANCE PICK-OFF

MAGNETIC DAMPING

OPERATING TEMPERATURE -65°F to +250°F

NO WARM-UP TIME REQUIRED

HERMETICALLY SEALED

In the Honeywell A-C Linear Accelerometer, Type LA-600, friction introduced through bearings and potentiometer slide wires is eliminated. This unit consists of a non-pendulous seismic mass supported on a frictionless spring suspension and incorporates an a-c variable reluctance type pick-off.

Inherently insensitive to cross-coupling accelerations both when at null and when at an acceleration along its sensitive axis, the Type LA-600 also features magnetic damping for near-constant damping ratio throughout its wide range of operating temperatures. Mechanical stops prevent damage from input accelerations beyond the specified full scale range. Write for Bulletin LA-600, Minneapolis-Honeywell, Boston Division, Dept. 1, 40 Life Street, Boston 35, Mass.

Honeywell

H HONEYWELL *Military Products Group*

DESCRIPTIVE DATA

FULL SCALE RANGE:	±0.5 to ±40 G
FULL SCALE OUTPUT:	Up to 10v, 400 cps into 100 K load; Up to 8v, 400 cps into 10 K load
THRESHOLD-RESOLUTION:	.0001G
CROSS-AXIS SENSITIVITY:	.005G maximum
VIBRATION:	10G, 0-2000 cps
SHOCK:	Up to 60 G
WEIGHT:	1.2 pounds maximum

THE TECHNOLOGY REVIEW, November, 1958, Vol. LXI, No. 1. Published monthly from November to July inclusive at Emmett Street, Bristol, Conn. Publication date: twenty-seventh of the month preceding date of issue. Annual subscription, $4.00: Canadian and Foreign subscription, $4.50. Entered as second-class matter December 23, 1949, at the Post Office, at Bristol, Conn., under the Act of March 3, 1879.

LUMMUS ENGINEERS AND CONSTRUCTS 20 COMPLETE REFINERIES SINCE END OF WORLD WAR II

World-wide Lummus Organization also completed hundreds of other units in same period . . . From Cardon, Venezuela, to Bombay, India—from Corpus Christi, Texas, to Turku, Finland—this string of modern "grass-roots" refineries testifies to the engineering skill of the Lummus staff. That staff includes over 3,000 permanent employees, located in seven branch offices and subsidiaries throughout the world.

When you plan a new facility—oil refinery, chemical or petrochemical plant—Lummus can put 50 years of experience on more than 700 process-industry plants throughout the world to work for you.

1. Refinery for Compañia Shell de Venezuela at Cardon, Venezuela
2. Refinery for Koppartrans Oljeaktiebolag at Gothenburg, Sweden
3. Refinery for Venezuela Gulf Refining Company at Puerto La Cruz, Venezuela
4. Refinery for Societe Generale des Huiles de Petrole at Dunkirk, France
5. "Portable" refinery for U. S. Navy Department
6. Lube oil refinery for Cit-Con Oil Corporation at Lake Charles, Louisiana
7. Refinery for International Refineries Inc. at Wrenshall, Minnesota
8. Refinery for Vacuum Oil Company Ltd. at Coryton, England
9. Refinery for Burmah-Shell Oil Company at Bombay, India
10. Refinery for Standard-Vacuum Oil Company at Bombay, India
11. Refinery for Standard Oil Company (Indiana) at Mandan, North Dakota
12. Refinery for Suntide Refining Company at Corpus Christi, Texas
13. Refinery for Commonwealth Refining Company at Ponce, Puerto Rico
14. Refinery for Esso Standard Oil Company at Antwerp, Belgium
15. Refinery for Caltex at Visakhapatnam, India
16. Refinery for Neste Oy at Turku, Finland
17. Refinery for Irish Refining Co., Ltd., Cork, Ireland
18. Refinery for Esso Standard Française, Bordeaux, France
19. Refinery for Purfina Mineraloelraffineria A.G., Duisburg, Germany
20. Refinery for B. P. Canada Limited Ville d'Anjou, Montreal, P.Q., Canada

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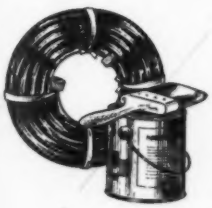

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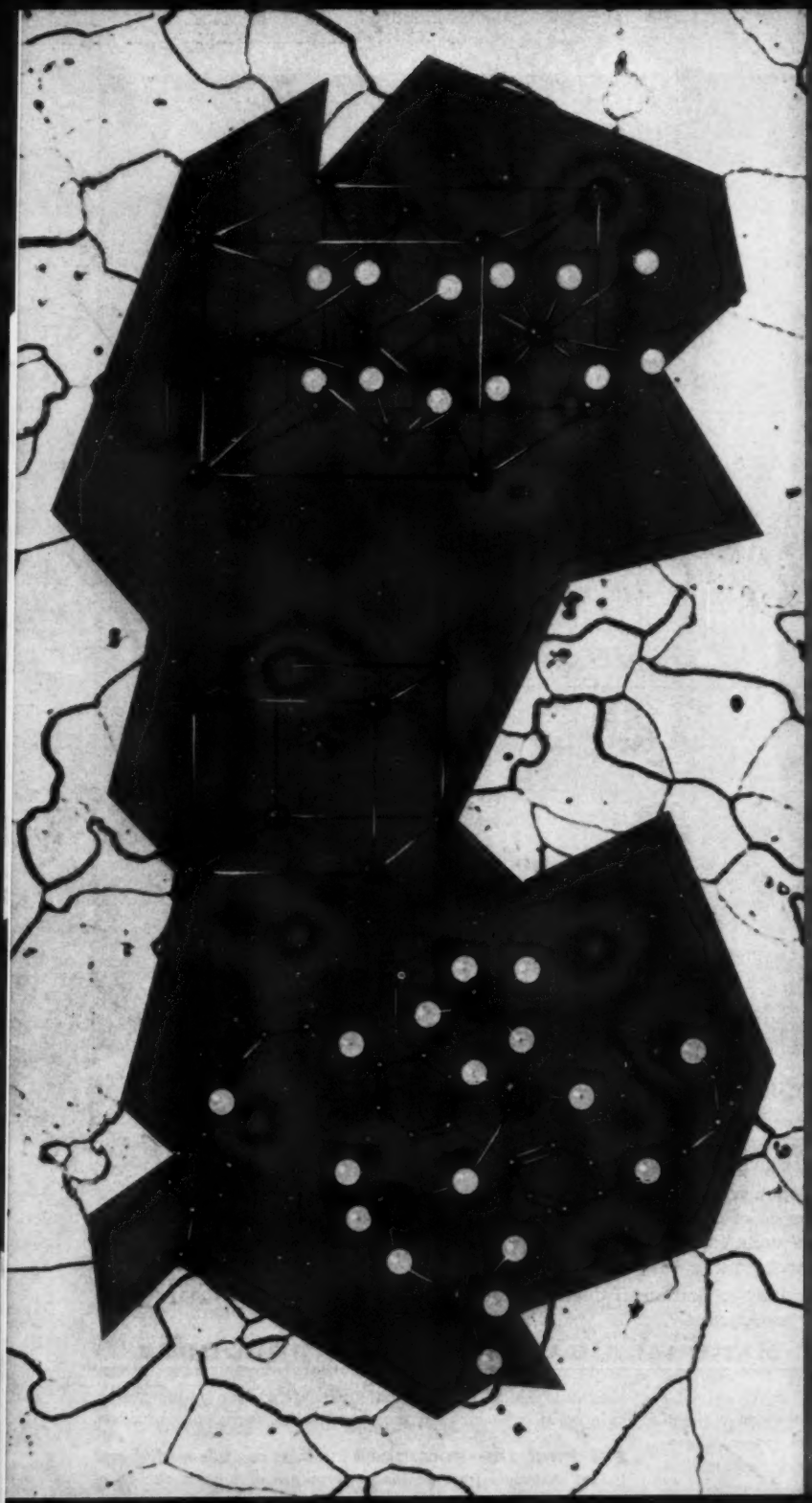
CABOT



NEW APPROACH TO "OLD" MATERIALS

By today's standards, the "old" refract metals are outdated. The ultimate in high-temperature studies of 10 years ag is several generations behind in terms of modern aircraft and missile develop

Today's material requirements surpass anything envisioned 10 short years ago. Molybdenum and beryllium, for examp are still exciting metals with much pro for space vehicles and ultra-high-speed aircraft. It now appears, however, that the full promise of such metals may be fulfilled when they are used, not alo nor as alloys, but when combined with other materials to form totally new types of structural materials.

Such a "marriage" of metals, ceramics and plastics is a promising approach to high-temperature problems that is being vigorously pursued at Avco. It opens new potential applications for many exotic combinations.

These bold steps forward are possible at Avco, where materials research includ concurrent basic studies and applied research, plus developmental programs extend through the solution of processi and testing problems.

The search for new knowledge goes forward simultaneously with the creati advanced technology at Avco's Researc and Advanced Development Division. T creative man, whether he is interested i basic studies or practical problems, find effort enhanced by the stimulus of interdisciplinary contact and feedback from other related fields.

Research and Advanced Development is more than a descriptive title at Avco. It is a concept that promotes creativity.

Avco

Research and Advanced Development division

For information on unusual career opportunities for exceptionally qualified scientists and engineers, write to: Dr. R. W. Johnston, Scientific and Technical Relations, Avco Research and Advanced Development D 201 Lowell Street, Wilmington, Mass.

For Career Opportunities in Nuclear Energy . . . Look to M&C NUCLEAR, INC.

With six years of experience in producing nuclear fuel to meet the needs of a progressing industry, M & C has developed techniques for manufacturing many types of fuel elements. In addition to fuel assemblies for reactors, M & C supplies the nuclear industry with complete reactor cores, core components, and fabricates a variety of materials into tube, disc, foil and plate forms for nuclear experiments.

M & C Nuclear, Inc. is growing to meet the expanding requirements of the nuclear industry and, as an important part of this growth, scientifically trained people are needed — people experienced in the metallurgical, mechanical, or industrial fields. Experience in atomic energy is desirable, but is not a fundamental requirement.

For more information, write or call the Employment Director.

MIT ALUMNI

Michael Anthony	1932	Herbert Graetz	2-1944	John Reynolds	1952
Chester Avery	1923	Daniel Hamilton	1954	Robert Seavey	1942
Frank Binns	1951	Roger Hood	1945	Frederick Stearns	1946
William Clemons	1950	Donald Hurter	1945	A. Graham Sterling, Jr.	1949
Kenneth Fettig	1957	Edward Jastram, Jr.	1935	Robert Teeg	1958
Robert Flanders	1958	Peter Lynch, Jr.	1958	Marvin Turkanis	1953
Harold Friedman	1956	John Medgyesy	1952	George Williams	1939
Robert Glidden	1926	Robert Packard	1953	Carroll Wilson	1932
		Charles Patterson	1945	John Wilson	1941

M&C NUCLEAR, INC.

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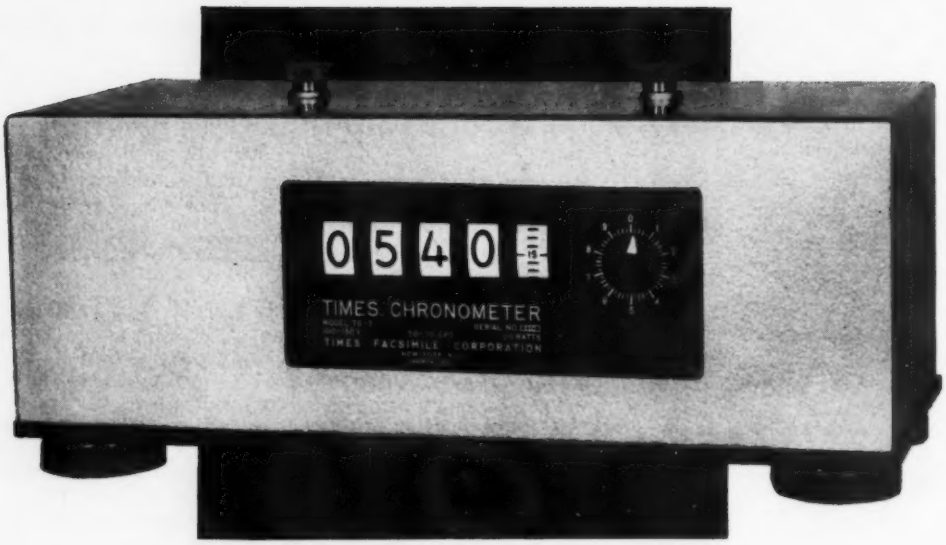
accurate to 1 second in 12 days



TIMES MODEL TS-3 CHRONOMETER

Program timer, pulse generator and clock. Timing assemblies, driven by the clock motor, provide momentary contact closings at rate of

• ONCE A SECOND • ONCE A MINUTE • ONCE AN HOUR

also optional frequency or pulse outputs as specified in range between 10 and 1000 cps.

PRICE: $950.00, F.O.B. Factory.

Optional frequency output, $50.00 each.

Write for details.

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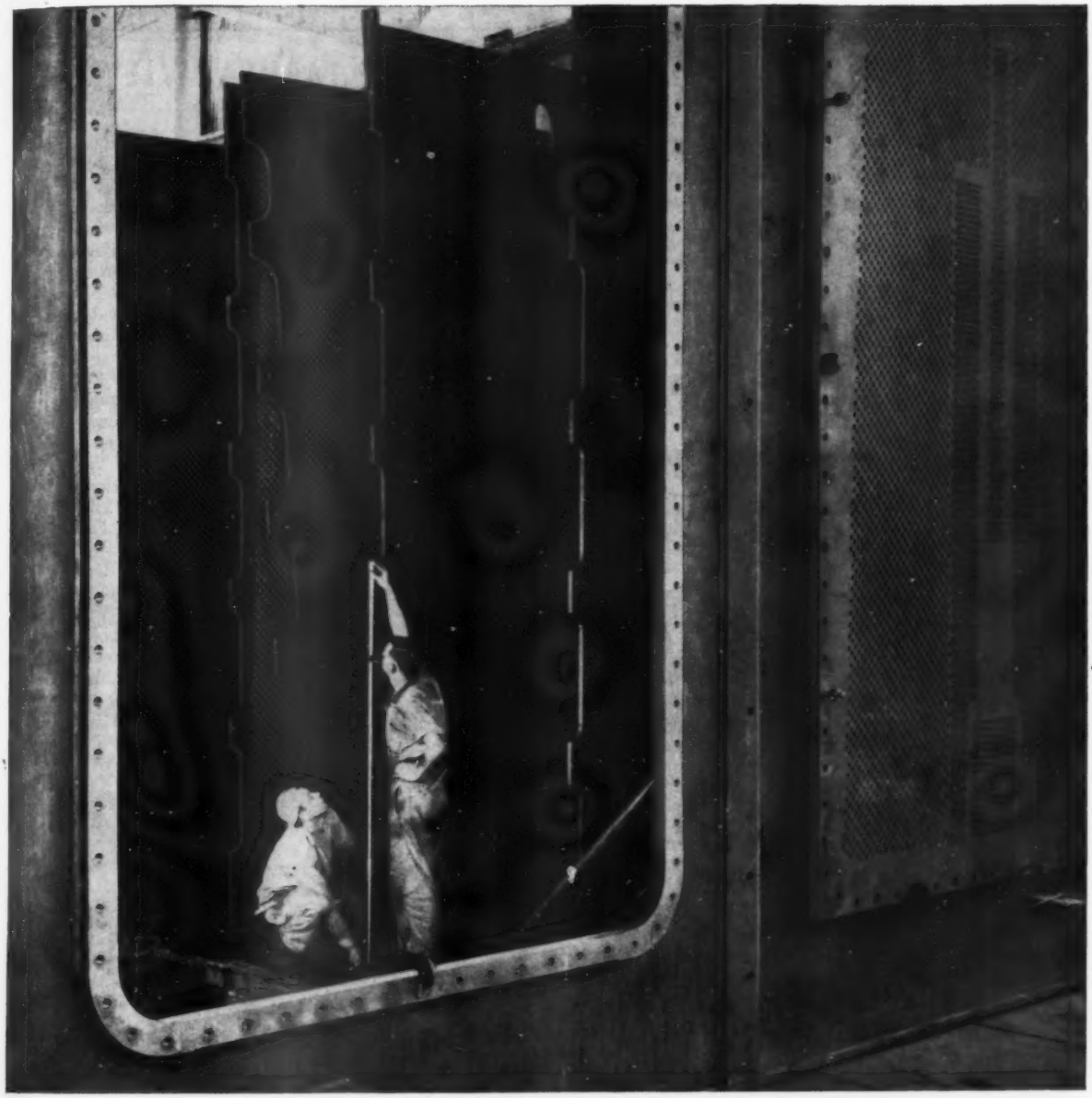
Class of 1924



Twin-shell, triple-lane, single-pass Condenser with 187,000 sq. ft. capacity. One of largest units ever built, it was recently installed at large eastern utility.

In tube layout, too... design makes the difference with C. H. Wheeler condensers

You see here one of the many reasons why C. H. Wheeler Dual Bank Surface Condensers operate so efficiently in scores of public utilities and industrial plants throughout the country.

Triple Lane Tube Layout, with three separate pathways for steam travel, allows the steam to penetrate to the peripheries of all tubes.*

Design like this, typical of C. H. Wheeler engineering, steps up condenser efficiency. Other engineering advancements—such as patented Reverse Flow, which permits flushing away leaves, twigs, algae and other foreign matter—reduce maintenance requirements. "Zero" condensate temperature depression, pure condensate and deaeration to 0.03 cc. of oxygen per liter (special design provides for deaeration to 0.01 cc. of oxygen per liter) . . . are additional features you get with C. H. Wheeler Condensers.

**Location of the air-vapor take-off reduces the resistance to steam passage. This minimizes the depth of steam penetration through the tube bank of all C. H. Wheeler Condensers.*

C. H. WHEELER MFG. CO.

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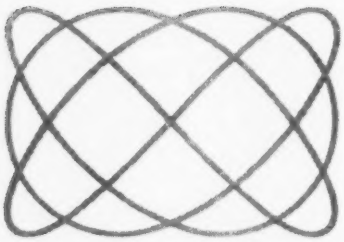
Whenever you see the name C. H. Wheeler on a product, you know it's a quality product

Steam Condensers • Steam Jet Vacuum Equipment • Centrifugal, Axial and Mixed Flow Pumps • Marine Auxiliary Machinery • Nuclear Products



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ENGINEERS

MATHEMATICIANS

are invited to join the Lincoln Laboratory scientists and engineers whose ideas have contributed to new concepts in the field of electronic air defense.

A brochure describing the following Laboratory programs will be forwarded upon request.

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SOLID STATE
AEW (air-borne early warning)
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In certain of these programs, positions of significant professional scope and responsibility are open to men and women with superior qualifications.

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MIT

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THE TABULAR VIEW

Report. — Always a stimulating and thought-provoking communication, the Annual Report of the President to members of the M.I.T. Corporation is prepared this year by J. A. STRATTON, '23, Acting President. In devoting a major portion of his significant message to general problems of higher education, Dr. Stratton summarizes (page 29) the plight of American colleges in the words: "The most fundamental problem, and the most difficult with which to cope, is the widening gap between the mean level of academic achievement in the average American secondary school on the one hand and the intellectual maturity of our top graduate professional schools on the other . . . The task of bringing even the most talented undergraduate student, in four years, to such a point of intellectual maturity that he may deal effectively either with the requirements of the top-rate graduate school or with the pressures of modern industry is a great and difficult one." With particular effectiveness since his appointment as Provost at M.I.T., Dr. Stratton has long emphasized quality in education.

Dr. Stratton received the S.B. and S.M. degrees from M.I.T. in 1923 and 1926, respectively, and the D.Sc. degree in 1927 from the Eidgenossiche Technische Hochschule of Zurich. He served as a member of the Institute's Faculty for many years, and following World War II established the M.I.T. Research Laboratory of Electronics, and served as its head until 1949 when he was appointed to the newly created post of Provost. He became vice-president in 1951, chancellor in 1956, and acting president in 1957.

(Concluded on page 10)

E D

America's largest Manufacturer of Filter Papers for Science and Industry

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E. H. Olmstead, President
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- Low attenuation
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- Uniform electrical properties over wide temperature variations
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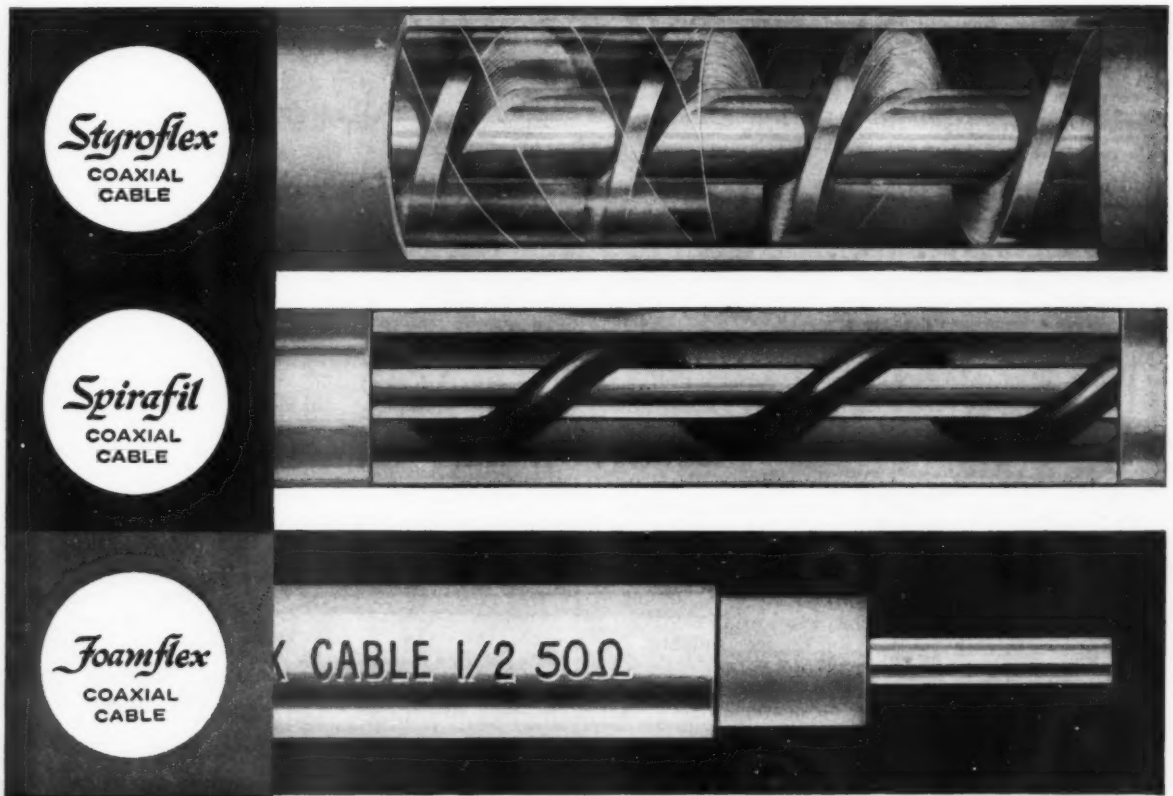
These are the Features of the

FINEST LINE OF HIGH FREQUENCY CABLES IN THE COMMUNICATIONS FIELD!



PHELPS DODGE COPPER PRODUCTS CORPORATION

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How Curtis helped a design engineer "BEAT THE HEAT"

This single universal joint in a ribbon-stripping machine was operated at a 34° angle. The joint heated up, wear was excessive. (Curtis Joints have been tested at angles up to 37°, but we do not recommend angles greater than 30°.)

Curtis engineers recommended a *double* Curtis joint, which reduced the angle to 17° per joint. Result: no overheating, improved efficiency, longer life.

You can depend on Curtis engineering in any problem of angular power transmission. And you can depend on

CURTIS UNIVERSAL JOINTS because our catalog torque and load ratings are substantiated by constant tests under production conditions.

14 SIZES ALWAYS IN STOCK
⅜" to 4" O.D.
(6" joints on special order)

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CURTIS
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Made to Your Specifications

You and we can form a team—you to draw up the specifications; we to make the gears—that will be profitable to both of us. Gears of all types, all sizes, all materials. Design-engineering service available.

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DIEFENDORF GEARS

THE TABULAR VIEW

(Concluded from page 8)

Progress. — Despite the fact that rumblings about the American educational system had been going on for years, it was only when Sputnik I reached orbit a year ago, that the public as a whole, took cognizance of this important problem. The progress in science and education that has been made in the past 12 months is recorded (page 33) by ALAN T. WATERMAN, Director of the National Science Foundation, who concludes that, "We have only made a beginning: the major job is still to be done. . . . In this modern world there can be no relaxation of our determination to compete successfully and continuously." Dr. Waterman was educated at Princeton University, from which he received the A.B. degree in 1913, the A.M. degree in 1914, and the Ph.D. in 1916. After teaching physics at Yale University for the period between the two World Wars, Dr. Waterman became chief scientist of the Navy's Office of Naval Research, was a member of the Office of Scientific Research and Development, and, in 1948 received the Medal for Merit. Upon the establishment of the National Science Foundation, Dr. Waterman was named its director. He is a fellow of the American Association for the Advancement of Science, American Physical Society, and the American Association of Physics Teachers.

Tour — At one time or another the Institute has been variously described as "a place not for boys to play but for men to work" or as a "university polarized around science." In recent years, emphasis has been placed on training "the whole man" and no better example of this objective is to be found than in the Institute's musical activities. This summer, for the second time, the M.I.T. Choral Society toured Europe where its performances in France, Belgium, and Germany were enthusiastically received. The saga of the Society's air trip to Europe and back is recounted (page 35) by ALICE JEGHELIAN, Secretary to the Institute's Dean of Students, John T. Rule, '21. Miss Jeghelian holds an A.B. degree from Mount Holyoke College and has been active in the Choral Society for several years. Last year she was secretary, and this year is president of this M.I.T. musical activity.

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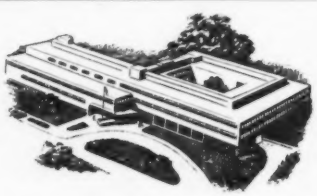

Speed and Economy

The quality of our construction service can be judged by the fact that, year after year, approximately 70% of our business comes from companies for whom we have built before.

If you are contemplating building, we believe it will pay you to consult us.

W. J. BARNEY CORPORATION
Founded 1917
INDUSTRIAL CONSTRUCTION
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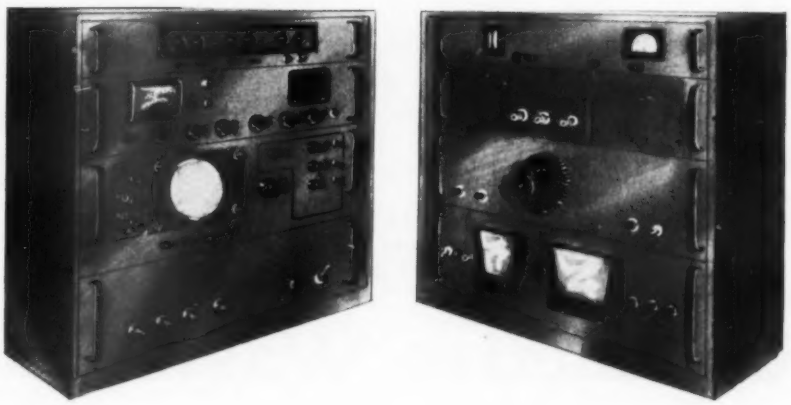
Progress in the Science of Chronometry

IN 1714, the British government offered a prize of £20,000 for any means of determining a ship's longitude within 30 nautical miles at the end of a six week's voyage. John Harrison, a self-educated Yorkshire carpenter, won the prize in 1760 with an accurate clock.

IN 1958, ICBM s and earth satellites created the need for new concepts in accurate timing. To fill this need, Hycon Eastern has developed an electronic Timing System with heretofore unattainable timing precision capable of operating anywhere in the world.

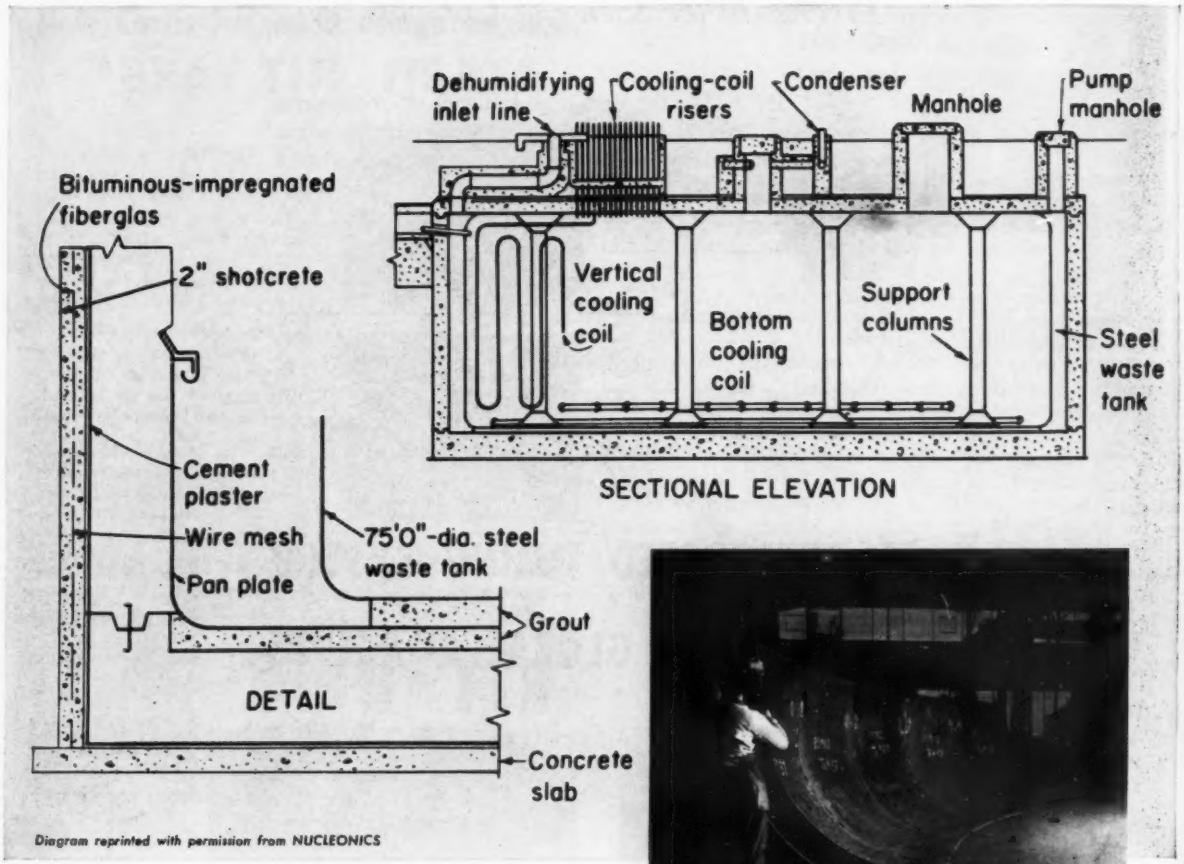
AN INTEGRATED TIMING SYSTEM FOR TODAY'S GLOBAL CONCEPTS



Solar or sidereal time is displayed visually and is available for input to automatic computers and indexing data with many types of recorders . . . magnetic tape, oscillograms, photographs and strip charts. Furnishing a time scale with resolutions available to one microsecond, this system is ideally suited for tracking and control of missiles, astronomical measurements, and navigation systems. Write for Bulletin TS-00.

HYCON EASTERN, INC.

75 Cambridge Parkway Dept. H Cambridge 42, Massachusetts



One AEC Solution To Radioactive Waste Storage

Storing radioactive wastes underground in huge 750,000 gallon double-bottomed steel tanks, as shown above, is one solution to the waste disposal problem at the AEC installations at Savannah River, S. C. and Hanford, Wash. Internal cooling coils take away the heat generated by radioactive decay. Remote handling protects personnel from high activity levels.

Graver has fabricated and erected sixty-eight such waste storage tanks for these nuclear installations. Special fabricating methods and field-erection techniques were required. For example, shop fit-up of the curved bottom plates expedited field assembly of the tanks.

The century-long experience of Graver in fabricating steels and alloys for a huge variety of processing equipment, pressure vessels and storage tanks admirably qualifies it to build for the future with America's important nuclear industry.

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Building for the Future on a Century of Craftsmanship in Steels and Alloys

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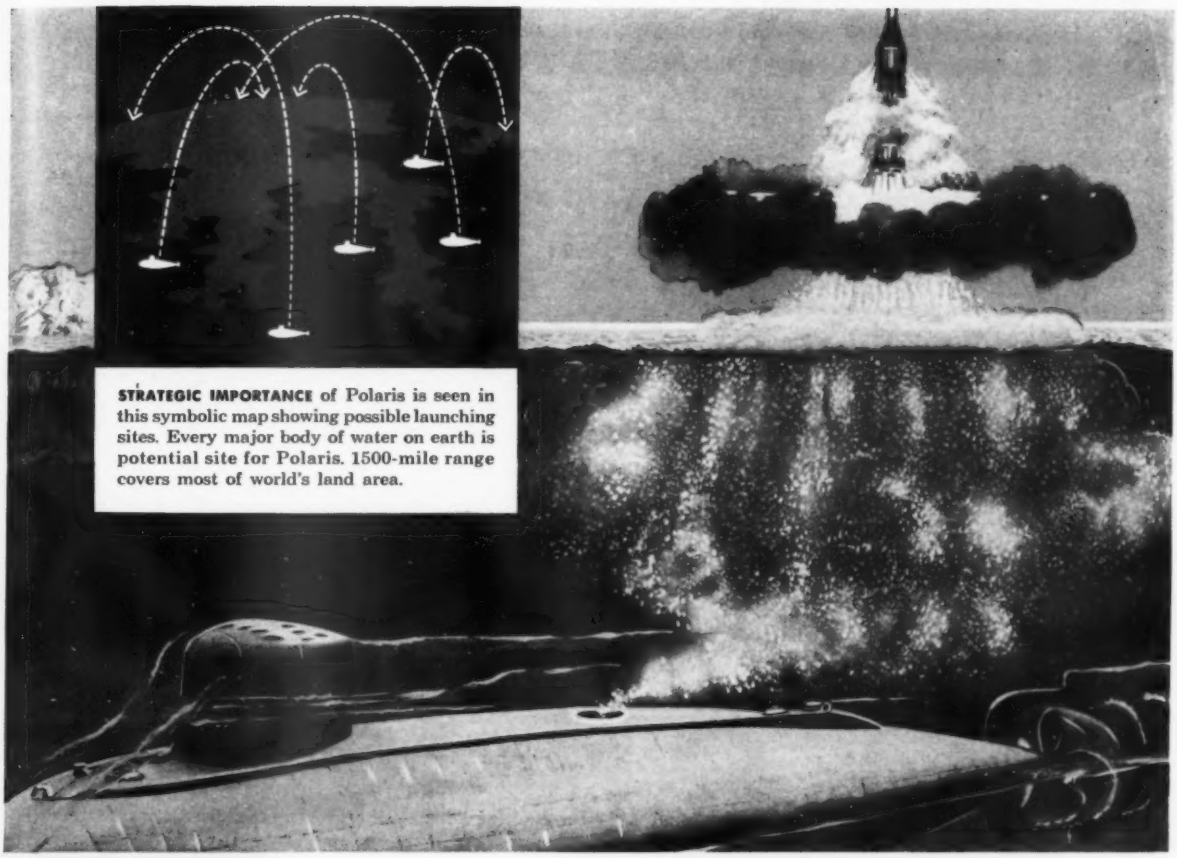

STRATEGIC IMPORTANCE of Polaris is seen in this symbolic map showing possible launching sites. Every major body of water on earth is potential site for Polaris. 1500-mile range covers most of world's land area.

CAREER ENGINEERS

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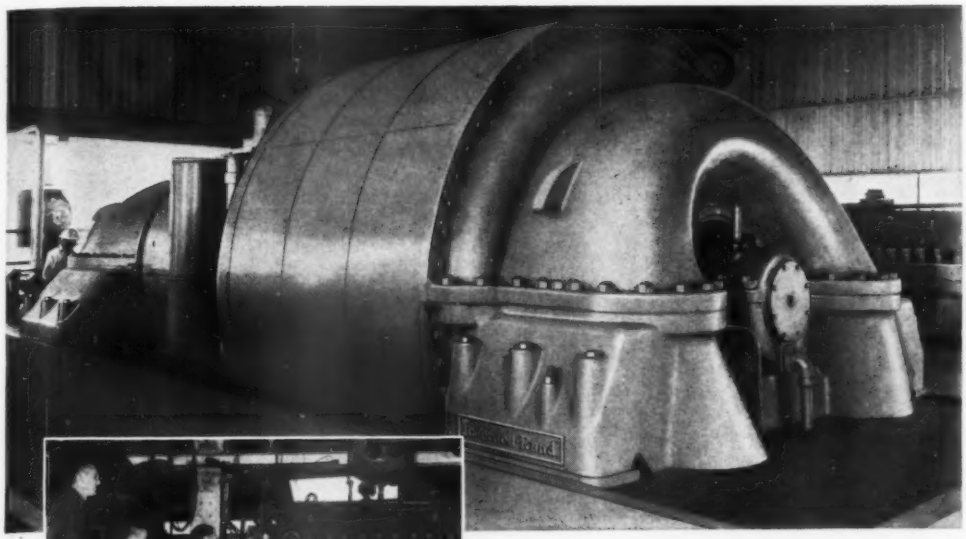

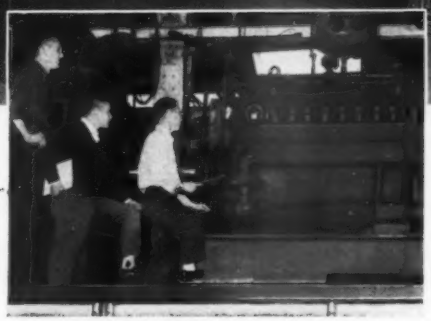

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LEFT: Engineering trainees at Ingersoll-Rand's Phillipsburg, N. J., plant check final performance tests on another blower of smaller size and higher pressure.

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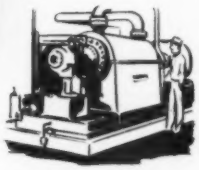

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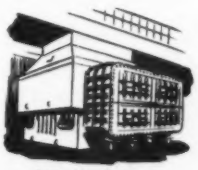
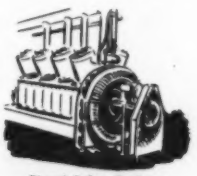


Steam Condensers



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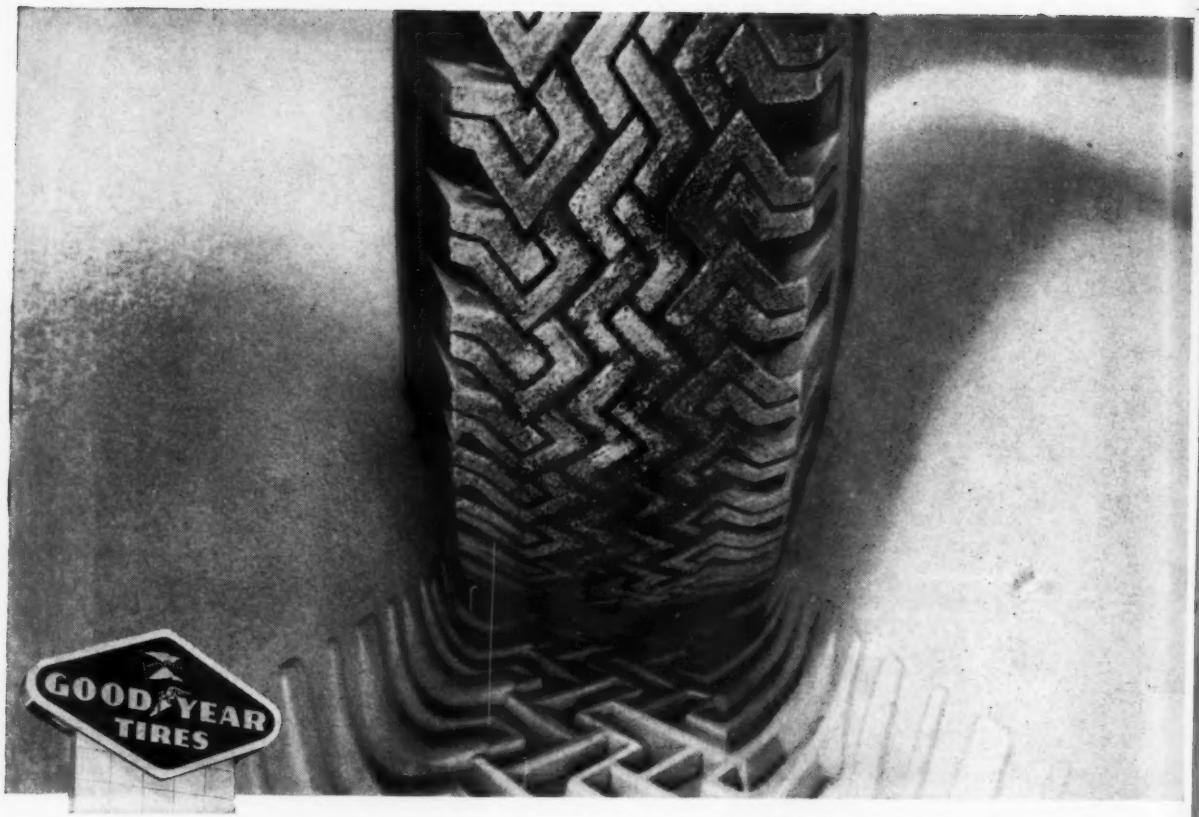

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THE TECHNOLOGY REVIEW

EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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Photograph by Raymond E. Hanson

EDITOR:
B. Dudley

BUSINESS MANAGER:
R. T. Jope

CIRCULATION MANAGER:
D. P. Severance

EDITORIAL ASSOCIATES:
Paul Cohen
J. R. Killian, Jr.
F. W. Nordsiek
J. J. Rowlands

EDITORIAL STAFF:
Ruth King
Shirley G. Reese
Winifred R. Sibley

BUSINESS STAFF:
Madeline R. McCormick
Catherine MacLachlan

PUBLISHER:
H. E. Lobdell

Published monthly from November to July inclusive on the twenty-seventh of the month preceding the date of issue, at 60 cents a copy. Annual subscription, $4.00; Canadian and foreign subscription, $4.50. Published for the Alumni Association of the M.I.T.; John J. Wilson, President; H. E. Lobdell, Executive Vice-president; D. Reid Weedon, Jr., William W. Garth, Jr., Vice-presidents; Donald P. Severance, Secretary-Treasurer. Published at Hildreth Press, Inc., Bristol, Conn. Editorial Office, Room 1-281, Massachusetts Institute of Technology, Cambridge 39, Mass. Entered as second-class mail matter at the Post Office at Bristol, Conn. Copyrighted, 1958, by the Alumni Association of the Massachusetts Institute of Technology. Three weeks must be allowed to effect change of address, for which both old and new addresses should be given.

M.I.T. Photo

Control Room of the M.I.T. Reactor

The first stationary nuclear reactor to be built in New England — a "tame" unit producing no power — was put into operation during the summer months at M.I.T. The new facility will be used for training nuclear science engineers, and for research in the physical and medical sciences.

The Technology Review

VOL. 61, NO. 1 NOVEMBER, 1958

The Trend of Affairs

Nuclear Reactor Now Operating

■ During the summer, the Institute's nuclear reactor was put into operation as an important new research facility for the physical and medical sciences in New England. "Tamed" atomic energy was demonstrated to members of the press on August 6, in the first tour of the new facility since it was completed. The general public had its opportunity to inspect the reactor at "Open House" on August 23.

At the press demonstration, operators at the control board showed how the splitting of atoms in the U^{235} fuel could be stepped up until a self-sustaining chain reaction was achieved, and how this reaction could be shut off. At the same time, radioactive iodine-131 was produced by exposing iodine to the reaction.

The tour was conducted by Theos J. Thompson, Director of the M.I.T. Reactor and Professor of Nuclear Engineering, who explained that the new facility will be operated only at low temperature and is not intended for power production. Primarily, the reactor is a facility for research and for the training of nuclear engineers.

The M.I.T. reactor is located on Albany Street in Cambridge, a short distance from the Institute's main group of academic buildings. It is readily accessible to educational, medical, and research institutions in Metropolitan Boston. The new $3,000,000 research facility includes buildings for offices, classrooms, laboratories, and shops. Much of its cost was underwritten by Technology Alumni as a memorial to the late Karl T. Compton. Medical facilities at the reactor were made possible by a grant of $250,000 from the Rockefeller Foundation. The National Science Foundation contributed $500,000 to the total cost, and the Atomic Energy Commission made available five tons of heavy water for its operation.

Except for propulsive reactors installed in atomic submarines built at New London, Conn., the M.I.T. reactor is the first such facility in New England, although many more reactors have been built in other parts of the country. The reactor was designed at M.I.T. under the direction of Dr. Thompson, who has had extensive experience in the field of atomic energy. A unique feature is the medical therapy room, located beneath the reactor core, where patients may be treated for such ailments as brain tumors.

Although medical treatment and research will be important phases of the reactor program, there will be many other uses. It will serve as a laboratory in the training of engineers and scientists in the newly established Department of Nuclear Engineering at M.I.T. It will be one of the most versatile research facilities at M.I.T. and will be employed in a wide range of research in such fields as physics, biology, metallurgy, mechanical engineering, and food technology. The reactor will be available for research by private industries, other colleges, and government agencies. As Dr. Thompson explained –

"Basic research programs which combine the use of the professional talents and research interests of the M.I.T. staff with the utilization of the reactor experimental facilities will be encouraged whenever possible.

"M.I.T. feels a strong obligation to aid Massachusetts and New England, as well as the entire nation, in developing and exploiting to its fullest extent the potentialities of atomic energy. The peaceful uses of atomic energy are certain to be of great value to the general public and to industry."

The reactor has been described as a "cool" or "tame" type, since it will operate at a temperature of only 104 degrees F. – about that of a warm bath. Unlike power reactors, in which heat is converted into electricity, heat from the M.I.T. reactor will be deliberately dissipated through the cooling system. The principal product of the atomic reaction in the reactor will be radiation, especially particles known as slow neutrons. From the reactor also will come gamma rays – the same kind of radiation as that produced by x-ray machines, but more energetic.

These radiations can be used for many purposes, such as the study of the structure of the nuclei of atoms and the molecular structure of crystals, the testing of metals and other materials, and research regarding the biological effects of radiation.

The reactor will usually operate 24 hours a day but will be shut down on Saturdays and Sundays, Dr. Thompson said. The first shift of the week will be devoted to checking all parts of the reactor.

Individuals Noteworthy

■ Prominent in the news since The Review's last issue have been the 27 promotions, elections, or appointments enumerated below:

Merrill E. Pratt, '16, as Chairman, Continental Gin Company . . . *Joseph L. Gillson, '21,* as President-elect, American Institute of Mining, Metallurgical, and Petroleum Engineers . . . *Latimer F. Hickernell, '22,* as President, American Institute of Electrical Engineers . . . *Bartow Van Ness, Jr., '22,* as Chief Electrical Engineer, Penn. Power and Light Co.;

Richard L. Bowditch, '23, and *John R. Newell, '34,* as Trustees, Bates College . . . *John T. Blake, '24,* as a Trustee, Tufts University . . . *Bernard E. Groenewold, '25,* as President, Midland Exploration Company, and as Vice-president, Sharp Drilling Company . . . *Walter Crafts, '26,* as Vice-president, American Society for Metals;

James W. Dunham, '26, as President, Midwest Carbide Corporation . . . *George J. Taylor, '26,* as President, Illuminating Engineering Society . . . *Charles C. Smith, '27,* as President, Auer Register Company, Cleveland, Ohio . . . *Robert C. Gunness, '34,* as Trustee, University of Chicago;

Brigadier General Joseph M. Colby, '35, as Deputy Commander, Army Ordnance Missile Command . . . *Major General William M. Creasy, Jr., '36,* as Vice-president, The Lummus Company . . . *P. William Bakarian, '37,* as President and General Manager, and *John S. Breitenstein, '40,* as Vice-president in charge of administration, R-N Corporation, subsidiary of National Lead Company;

Kenneth E. Fields, '38, as Executive Vice-president, International Standard Electric Corporation, overseas subsidiary of International Telephone and Telegraph Corporation . . . *Robert L. Johnson, '38,* as Vice-president and Treasurer, Boston Manufacturers Mutual and Mutual Boiler and Machinery Insurance Companies . . . *Gerald J. McCaul, '40,* as Executive Vice-president, Simmonds Aerocessories, Inc., Tarrytown, N.Y. . . . *Julius P. Molnar, '40,* as Vice-president, Western Electric Company, and as President, Sandia Corporation . . . *Kenneth M. Leghorn, '42,* as President, Bradley Container Corporation, subsidiary of American Can Company;

Virgilio Barco-Bargas, '43, as *Ministro de Obras Públicas,* Republic of Colombia . . . *Harold D. Peardon, '43,* as Vice-president, Electronics Corporation of America . . . *Albert P. Hildebrandt, '44,* as President, Lumber Fabricators, Inc., Fort Payne, Ala. . . . *Robert H. Symonette, '45,* as Deputy Speaker, House of Assembly of the Bahamas . . . *Albert E. Cookson, '51,* as Director, Missile Guidance Laboratory, I.T.T. Laboratories Division, International Telephone and Telegraph Corporation.

■ During the summer, special honors announced or awarded came to 22 Alumni and to a member of the Faculty as follows:

To *Charles M. Spofford, '93,* the Frank P. Brown Medal, to *Donald W. Douglas, '14,* the Franklin Medal, and to *Julian M. Avery, '18,* the Francis J. Clamer Medal, by the Franklin Institute;

To *Edith A. Beckler, '02,* the Lemuel Shattuck Award, by the Massachusetts Public Health Association . . . to *Herbert T. Kalmus, '04,* honorary membership, by the Society of Motion Picture and Television Engineers . . . to *Herbert J. Ball, '06,* honorary membership, by the American Society for Testing Materials;

To *Emory L. Chaffee, '07,* its Medal of Honor, by the Institute of Radio Engineers . . . to *Irving W. Wilson, '11,* an honorary doctorate of commercial science, by Duquesne University, and an honorary doctorate of laws, by Washington and Jefferson College . . . to *Jerome C. Hunsaker, '12,* its Distinguished Public Service Award, by the Department of the Navy;

To *Lucius A. Bigelow, '15,* the Herty Medal, by the Chemistry Club, Georgia State College for Women . . . to *Francis P. Scully, '15,* the Aladdin Lamp, by the Oil-Heat Institute of America . . . to *Frederick H. Norton, '18,* honorary membership, by the British Ceramics Society;

To *Charles A. Chayne, '19,* an honorary doctorate of engineering, by the University of Michigan . . . to *Léon G. Rucquoi, '24,* the grade of *Officier de l'Ordre de Léopold,* on nomination by the King of the Belgians . . . to *James R. Killian, Jr., '26,* the Gold Medal World Brotherhood Award, by the National Conference of Christians and Jews.

To *George J. Taylor, '26,* the grade of Fellow, by the American Institute of Electrical Engineers . . . to *Edward D. Stone, '27,* architect of the United States Pavilion at the Brussels Exposition, the grade of Fellow and an Award of Merit, by the American Institute of Architects . . . to *Hunter Rouse, '29,* the Vincent Bendix Award, by the American Society for Engineering Education;

To *Erskine G. Roberts, '32,* a citation for meritorious service to the people of Indiana, by the Governor of Indiana . . . to *Peter P. Alexander, '33,* an honorary doctorate of science, by Northeastern University . . . to *Gordon Bunshaft, '33,* the grade of Fellow, by the American Institute of Architects;

To *Major General William M. Creasy, Jr., '36,* the Distinguished Service Medal, by the Department of the Army . . . to *Carl F. J. Overhage,* Director of the Institute's Lincoln Laboratory in Lexington, its Exceptional Service Award, by the United States Air Force.

Aid to Air Defense

■ Formation of the Mitre Corporation, a new organization that will provide the United States Air Force with scientific and engineering services on problems in air defense, was announced on August 26, 1958, by J. A. Stratton, '23, Acting President of M.I.T.

The Mitre Corporation, a nonprofit organization sponsored by M.I.T., will provide the technical and systems support required for the integration of the nation's air defense systems. In this role, the new corporation will work with and assist the recently formed Air Defense Systems Integration Division of the U.S. Air Force, a tri-command unit which was formed early last spring at L. G. Hanscom Field in Bedford, Mass. Known as "ADSID," this new unit represents the Air Research and Development Command, the Air Materiel Command, and the Air De-

fense Command. Major General Kenneth P. Bergquist is commander of ADSID.

The Mitre Corporation will be staffed with scientific and engineering personnel on a gradual build-up basis at a rate determined primarily by requirements of the Department of Defense. It is expected that the initial nucleus of Mitre personnel will include some of the persons currently working at M.I.T.'s Lincoln Laboratory in Lexington, Mass. Officials at the Lincoln Laboratory indicated that most of the personnel moving to Mitre will come from among those who have been engaged in development of the SAGE (Semi-Automatic Ground Environment) air defense system.

Until the Mitre Corporation is able to assume its full responsibilities, the Lincoln Laboratory will continue to provide the scientific and engineering services required for systems support of air defense as "principal systems adviser" to the ADSID. When these tasks have been transferred to the new organization, Lincoln Laboratory will be able to concentrate its efforts on its basic mission of research in air defense electronics and related fields, and the early development of advanced systems emerging from such research.

The Mitre Corporation was officially incorporated on July 18. Currently, a Board of Trustees made up of representatives of industral, educational, and scientific organizations is being formed.

Heading the Board of Trustees is H. Rowan Gaither, Jr., chairman of the Board of the Ford Foundation. C. W. Halligan, Director of Military Engineering at the Bell Telephone Laboratories, Inc., will be president of the Corporation. He will have his offices at the Air Defense Systems Integration Division buildings at Hanscom Field.

Formation of the Mitre Corporation evolved from several years of study at highest levels in Washington. Following the reports of several special military-civilian committees studying current and future needs for managing the complex air defense effort, James H. Douglas, Secretary of the Air Force, invited the Institute to assist in this joint military-industry effort for air defense systems.

School Begins

■ Representing almost every state in the Union, and 26 foreign countries, 900 freshmen arrived at the Institute on September 18 for the annual freshman orientation week end that precedes the beginning of classes.

The Class of 1962, which includes 84 National Merit Scholars from 36 states, met for the first time on Thursday afternoon, September 18, in Kresge Auditorium. Their week-end schedule included a beach picnic, individual conferences with Faculty advisers, a tea for women students given at the home of Frederick G. Fassett, Jr., Dean of Residence, and a dance on Saturday night. Activities were concluded with a reception on Sunday afternoon for freshmen and their parents, given by J. A. Stratton, '23, Acting President, and Mrs. Stratton.

An additional 5,300 upperclassmen and graduate students registered on September 22, bringing the total enrollment for the fall term to 6,200 – a slight increase over last year's student body, despite higher tuition.

"We can help students meet the higher costs of education," said Thomas P. Pitré, Associate Dean, and Director of Student Aid at M.I.T., "because there are more industrial funds for scholarships than ever before. There are also part-time jobs for students at the Institute, and an increased loan fund which is available to freshmen for the first time this year."

A new resident tutorial plan, growing out of the Faculty resident system begun seven years ago, will go into effect in one M.I.T. dormitory this year. Professor Howard R. Bartlett, Head of the Humanities Department, will be the first master of Burton House. Assisted by two senior tutors and several other tutors, Professor Bartlett will have the responsibility for guiding and counseling undergraduates who live in Burton House.

Another "first" for M.I.T. students this term will be courses offered in the recently established Department of Nuclear Engineering. Using as its laboratory the new M.I.T. nuclear reactor, the Department is New England's first.

On the Horizon

November 8, 1958 – 13th M.I.T. Alumni Regional Conference, Albuquerque, N.M.

November 17, 1958 – Silver Stein Dinner, M.I.T. Club of New York, Hotel Biltmore, 43d Street and Madison Avenue, New York, N.Y.

January 31, 1959 – 14th M.I.T. Alumni Regional Conference, Detroit, Mich.

George W. Swett: 1881-1958

■ The Review records with regret the death of George W. Swett, '03, Professor of Machine Design, Emeritus, on September 30 in Brookfield, N.H. He was professor of machine design from 1929 until 1946, and was also secretary of the Faculty for many years.

Born in Troy, N.Y., Professor Swett was graduated from M.I.T. in 1903. That year he joined the Institute staff as an assistant in the Department of Mechanical Engineering and remained an active member of the Faculty until his retirement in 1951. From 1946 (when he was made professor emeritus) until 1951, he served part time as lecturer at the Institute. He was a member of the staff of the Lowell Institute School and was the first head of the Mechanical Engineering Department of Northeastern University.

Professor Swett was the author of the *Construction of Alignment Charts,* and co-author with the late Professor George B. Haven, '94, of texts including the *Design of Boilers and Pressure Vessels,* and *A Treatise on Leather Belting.* He was a member of the American Society for Testing Materials, the Society for the Promotion of Engineering Education and the American Association for the Advancement of Science.

Professor Swett is survived by his wife and two daughters – Mrs. Howard Sinclair Turner and Mrs. Wallace R. Creelman.

Metropolitan Photo

Happily celebrating their 25th reunion June 14 to 16, members of the Class of 1933 and their wives gathered on the steps of Walker Memorial (as shown above and on the opposite page), just after the Faculty Luncheon in Walker. With reunion head-

Faculty Appointments and Promotions

■ New appointments and promotions on the Institute's Faculty, announced during August, numbered three named to full professorships, two associate professorships, and 23 men who become assistant professors. The three full professors are: Captain Edward S. Arentzen, '43, U.S.N., Professor of Naval Architecture and Marine Engineering; Evsey D. Domar, Professor of Economics; and Kenkichi Iwasawa, Professor of Mathematics.

Captain Arentzen, a graduate of the U.S. Naval Academy, received his master's degree in Naval Architecture from M.I.T. Before joining the Institute's Faculty, he was head of the Preliminary Design Branch, Bureau of Ships in Washington, D.C.

Dr. Domar was at M.I.T. during the spring term of 1957 as a visiting professor from the Johns Hopkins University, where he has been professor of political economy. He was formerly director of Russian studies for the Operations Research Office of the Johns Hopkins University, and has lectured at the Russian Institute of Columbia University.

Dr. Iwasawa, formerly Associate Professor of Mathematics, received both his undergraduate and doctorate degrees in mathematics from Tokyo University, where he taught until 1950. He came to the United States as a member of Princeton University's Institute for Advanced Study and joined the M.I.T. staff in 1952.

To serve as associate professors are: Albert Bush-Brown, Associate Professor of Architectural History in the Department of Architecture; and Daniel M. Holland, Associate Professor of Finance in the School of Industrial Management.

Professor Bush-Brown received the bachelor and master of fine arts degrees from Princeton University. In addition to his courses on the history and theory of architecture in the Department of Architecture, he will take part in the visual arts program begun last year in the Humanities Department. Dr. Holland was at M.I.T. as a visiting lecturer during the spring term of 1957, and during the past year has been associate professor of economics at New York University. Professor Holland received his undergraduate and doctorate degrees in economics from Columbia University. He is a specialist in the field of public finance and fiscal policy, and has been a member of the research staff of the National Bureau of Economic Research since 1952.

Joining the ranks of the Institute's assistant professors in various departments are: *Chemical Engineering* – Charles M. Mohr, '55; *Chemical Engineering Practice* – David H. Klipstein, '56; *Chemistry* – Walter Thorson; *Economics and Social Science* – David M. Green, '57, Thomas M. Lodahl, and George O. Totten, 3d; *Electrical Engineering* – Dudley A. Buck, '52, Ronald A. Howard, '55, William D. Jackson, Richard C. Jeffrey, Paul R. Johannessen, '52, Arthur L. Loeb, John McCarthy, Charles W. Merriam, 3d, '55, Albert H. Nuttall, '54, and David R. Whitehouse, '54; *Industrial Management* – Victor L. Andrews and Martin Greenberger; *Mathematics* – George Backus and Franklin P. Peterson; *Mechanical Engineering* – Philip G. Hill and Yasutoshi Senoo; *Physics* – Kenneth A. Johnson.

quarters at Baker House, M.I.T., most of the events were held on campus, and culminated with Alumni Day activities on Monday, June 16. Charles C. Bell and Robert M. Kimball were chairman and vice-chairman, respectively, of the reunion.

Visiting Professors on Campus

■ Impressive is the list of eight visiting professors who will be on the M.I.T. Campus for the academic year 1958–1959. In August, J. A. Stratton, '23, Acting President of the Institute, announced the appointment of these men who, with broad backgrounds in industrial experience or from universities in this country and overseas, will widen horizons at M.I.T.

Starting the roster with the three appointees in what is still one of the larger departments at the Institute (Electrical Engineering, Course VI), their respective posts are described in the following paragraphs.

Paul F. Chenea, Acting Head of the School of Electrical Engineering, Associate Dean of Engineering, and Head of the Division of Engineering Science at Purdue University, will be Visiting Webster Professor of Electrical Engineering at the Institute for the year 1958–1959. While occupying the Webster chair, Professor Chenea will participate in the Electrical Engineering Department's teaching and research program in electrodynamics and materials.

The Webster chair was established at M.I.T. in 1952 under a grant of $400,000 from the Edwin Sibley Webster Foundation in memory of the late Mr. Webster, one of the Institute's most distinguished Alumni. Edwin S. Webster, for whom the chair is named, was graduated from M.I.T. in 1888 and founded with his classmate, the late Charles Stone, the national organization of Stone and Webster, Inc., the first electrical engineering consulting firm in this country.

Dr. Chenea, who did his undergraduate work at the University of California, received the Ph.D. degree from the University of Michigan. He taught there until 1952, when he was appointed a professor at Purdue University. Specializing in the fields of servomechanisms, theory of elasticity, vibration analysis and advanced dynamics, Professor Chenea has co-authored two books: *Mechanics of Vibration*, with H. M. Hanson; and *Engineering Mechanics*, with T. A. Hunter.

Nathaniel Rochester, '41, manager of the Department of Information Research, International Business Machines Corporation, has been appointed visiting professor of communication sciences in the Department of Electrical Engineering. Professor Rochester will lecture in the field of data processing, and will work closely with the staff of the Institute's recently established Center for Communication Sciences.

The objective of the new M.I.T. Center is to arrive at a better understanding of communication and a more effective use of machines through the collaborative work of mathematicians, electrical engineers, linguists, psychologists, physiologists, and others. They will study communication functions of both the human nervous system and such machines as computers, as well as methods of communicating between the two.

Professor Rochester was graduated from M.I.T. in 1941 with an S.B. degree in Electrical Engineering, and worked for two years with M.I.T.'s Radiation Laboratory during World War II. Joining the I.B.M. staff in 1948, he worked on the development of a tape-processing machine. He was instrumental in the

Shown above are classmates and guests of the Class of 1908 as they celebrated their 50th reunion on the week end of June 13-15 at Snow Inn, Harwich Port. Members of the Class in the front row (left to right) are: Miles Sampson, H. Leston Carter, Edward J. Riley, George Schobinger, Howard B. Luther, Samuel F. Hatch, Harold H. Howland, Karl R. Kennison, George E. Freethy, Richard C. Collins, James M. Burch, Jr. Middle Row: *Leslie B. Ellis, Harold E. Weeks, Harold S. Osborne, Henry H. Damon, Frank W. Sharman, Franklin T. Towle.* Back Row: *Harry A. Rapelye, Paul W. Norton, Edgar I. Williams, Myron M. Davis, George M. Belcher, Henry W. Blackburn, William C. Taylor, Charles M. Steese, Carl A. Hall, Frederick A. Cole, William H. Medlicott, Harold W. Griswold, Joseph Pope, Clarence H. Spiehler, Charles F. Joy, Jr., Wilfred E. Booth, Harry S. Chandler, Henry R. Sewell, Charles A. Edmonds. Attending the reunion but not present when the picture was taken were Monroe Ames, Raymond E. Drake, Joseph W. Wattles, 3d, and their wives, and John R. Reyburn.*

development of several of I.B.M.'s large-scale computers, and in 1955 organized the I.B.M. Department of Information Research.

Concluding visiting personnel in the Department of Electrical Engineering is Laurel J. Lewis, Visiting Professor of Electrical Engineering. Dr. Lewis is professor of Electrical Engineering at the University of Washington. He received both his undergraduate and doctorate degrees from Stanford University where he taught for several years after graduation.

In the Institute's Department of Biology, Salvador E. Luria will be visiting professor of biology, and Vernon M. Ingram has been appointed visiting associate professor of biochemistry. Dr. Luria comes to M.I.T. from the University of Illinois, where he has been professor of bacteriology for eight years. A native of Turin, Italy, Professor Luria received the M.D. degree at the University of Turin. Since coming to this country in 1940, he has done research in bacteriology at Columbia University, and as a Guggenheim Fellow at Vanderbilt and Princeton Universities. In 1950 he was Jessup Lecturer at Columbia University. Dr. Ingram, born in Germany, first came to this country following his graduation from the University of London where he received the Ph.D. degree. He spent a year at the Rockefeller Institute in New York and at Yale University before returning to England, where he has been a staff member of the Medical Research Council at Cavendish Laboratory in Cambridge. Dr. Ingram is the first scientist to discover exactly how a vital component of the human blood cell is damaged by an inherited disease. He has been able to put biologists on the right track concerning an inborn error of heredity, through his studies of sickle cell anemia at the Cavendish Laboratory in Cambridge, England.

The Department of Economics and Social Science will welcome Erik H. Erikson, Visiting Professor of Communications, and Henry R. Strotz, Visiting Professor of Economics. Professor Erikson, born in Germany, came to the United States in 1933 following his graduation from the Vienna Psychoanalytic Institute. Since 1951 he has been professor of psychology at the University of Pittsburgh School of Medicine, and he is a senior staff member at the Austen Riggs Center in Stockbridge, Mass. Professor Erikson has pioneered in the application of psychoanalysis to children for the prevention of mental illness. He is the author of numerous articles on that subject, as well as the book *Childhood and Society*. Dr. Strotz received both his undergraduate and doctorate degrees from the University of Chicago. He is professor of economics at Northwestern University, and is also managing editor of *Econometrica*, which is published by the Econometric Society.

Concluding the above list is John C. Fisher, '47, Visiting Professor of Engineering. Dr. Fisher, a research associate with the General Electric Company, has been a visiting lecturer in the M.I.T. Metallurgy Department for the past seven years. He is a graduate of Ohio State University and received his doctorate from the Institute.

John A. Rockwell: 1872-1958

■ Dr. John A. Rockwell, '96, for whom the Rockwell Athletic Cage at the Institute is named, died in Cambridge on July 23. Dr. Rockwell was 86 years old. During his life he devoted 50 years of service to athletics at M.I.T., and in 1955 was the recipient of a citation from the Massachusetts Memorial Hospitals, also for 50 years of service.

Born in 1872 in Atlanta, Ga., Dr. Rockwell attended Norwich Academy and received an S.B. degree from M.I.T. in 1896. He then entered Boston University School of Medicine and was graduated in 1899. He started practicing medicine in Cambridge in 1902, and was on the staff of the Massachusetts Memorial Hospitals, which was then known as the Massachusetts Homeopathic Hospital. He was also associated with the Mount Auburn and Hahnemann hospitals. Dr. Rockwell was one of the early re-

searchers in x-ray work and suffered from its results in his life.

An excellent track and football man, Dr. Rockwell held a keen interest in intercollegiate and amateur athletics. His particular interest was wrestling, and he was instrumental in establishing wrestling as an intercollegiate sport in the East.

Interested in M.I.T. athletics from his student days, he (with Thomas Hibbard, '75, and Frank H. Briggs, '81) represented the Alumni Association in the organization of the Advisory Council on Athletics on January 18, 1898, and served continuously on this Council, interrupted only by service in World War I, until the Council ceased its guidance of M.I.T. athletics in 1947. Commemorating his service as a charter member of the Council and as its chairman from 1910 until 1947, the Institute dedicated the Rockwell Athletic Cage in his honor on Alumni Day, June 12, 1948. Also in his honor was the christening in 1942 of a crew shell, the *John A. Rockwell, '96.*

Throughout his life, Dr. Rockwell served M.I.T. by contributing generously of his time and wise counsel – to the Class of 1896 (as its assistant secretary and secretary for many years), to the Alumni Association (as a member of the Alumni Council from 1919–1958), and to generations of M.I.T. men.

He was a member of the Oakley Country Club, Boston Art Club, Army-Navy Club of Washington, Accomac Club (Virginia), and Theta Xi fraternity.

He is survived by his wife, the former Isabelle Barnes, and a sister, Mrs. Edward S. Cole of Upper Montclair, N.J.

Administrative Appointments

■ Appointment of Walter L. Milne as administrative assistant to the President of the Institute was announced in August by J. A. Stratton, '23, Acting President. George D. Wood, Jr., has been appointed to succeed Mr. Milne as assistant to the Director of Public Relations.

Mr. Milne came to the Institute in 1951 after serving as an instructor in English at Brown University and Worcester Polytechnic Institute. A native of Fall River, he received A.B. and A.M. degrees at Brown, in 1943 and 1947, respectively, and was a lieutenant (j.g.) in the Navy during World War II.

Mr. Wood, who was born in Shelburne Falls, Mass., received a B.A. degree from American International College and an M.S. from the Boston University School of Public Relations. At the American International College, he was head coach of football and director of the News Bureau, and at Boston University he was the assistant to the Director of Publicity for three years. In 1951 he became a civilian public relations official for the United States Air Force, handling public information for the Northeastern Air Procurement District, and in 1953 was appointed civilian public relations and public information chief for the Air Force Cambridge Research Center. More recently he has been with Val Laughner Associates.

During World War II, Mr. Wood served as a first sergeant in the Combat Engineers in the European Theater of Operations for 15 months. For nine years he was a member of the Army Counter Intelligence Reserve Corps.

Athletic Résumé, 1957-1958

■ The year 1957–1958 made the M.I.T. community proud of its athletic teams. In the fall of 1957, the sound of the M.I.T. soccer team was heard all over the world. Twelve different countries were represented on the internationally flavored Tech squad, and the season was completed with a record of seven wins, one loss, and one tie. An unprecedented accomplishment for the soccer team was that it ranked second to Springfield College in the New England Soccer League, and two men were selected for the Second All Star Team, with one being selected for honorable mention. In the fall, as well as in the spring, the sailing team was a consistent winner, recording wins over practically every major school in the East.

Seventeen M.I.T. winter sports teams competed in 174 intercollegiate events during the winter months. From the New England Intercollegiate Fencing Championships, the Tech fencers came home with two trophies for first place in the individual foil and *épée* categories, and as a school placed second in New England. Many Tech records were broken during the New England Intercollegiate Swimming Championships. Squash, pistol, and rifle teams also recorded good seasons. M.I.T.'s record was low in basketball and hockey in the usual sense, but high in the satisfaction that the competition brought to the players.

The Institute's spring season was highlighted by two events. First, Tech had its first baseball victory in history over Harvard. This feat was particularly significant inasmuch as Harvard won the Ivy League Championship and was a "push-over" for none but M.I.T. The Tech lacrosse team capped the most successful season in its history by winning the Taylor Cup – symbolic of the National Class C Championship, achieving an 8-2 record for the season. The high point of the season was the rallying 6-5 victory over Harvard – M.I.T.'s first Crimson conquest since 1942.

The Review is pleased to present, in the following paragraphs, reports on four athletic teams as prepared by: Coach Robert M. Whitelaw on varsity baseball and freshman basketball; Coach John H. Burke, Jr. on varsity basketball and golf.

Baseball

The varsity baseball team opened its ambitious 16-game schedule by losing to Boston College. The second game of the season made M.I.T. baseball history as sophomore Richard H. Oeler, '60, starting his first varsity game, beat Harvard 2-0 while limiting the Crimson to two hits behind the excellent defensive support of the Tech team. The victory was the first baseball win in history over Harvard.

Highlighting the offensive power of the scheduled games was the slugging of Captain-Elect Warren H. Goodnow, '59, which included four doubles, one triple, and three fence-clearing home runs. Warren was elected to the Greater Boston Baseball League All-Star Team at the completion of the season's play.

Plagued with the usual crippling team injuries and scholastic pressures, the team members maintained

(Continued on page 40)

Charles B. Breed: 1875-1958

■ Charles B. Breed, '97, Professor of Civil Engineering, Emeritus, died in Camden, Maine, on August 9 at the age of 82 years. Professor Breed, Head of the Department of Civil and Sanitary Engineering from 1934 to 1944, was widely known as a consulting engineer and author of engineering textbooks. He was an authority on the elimination of grade crossings, and served as consultant to several state public utility commissions on problems pertaining to valuations, bridges, traffic control, pavement design and performance.

Born in Lynn on November 28, 1875, Professor Breed was graduated from M.I.T. in 1897. The following year he returned to the Institute as an assistant in Civil Engineering, and remained an active member of the Faculty until his retirement in 1946. He became an assistant professor in 1907, associate professor in 1910, and professor in 1914. From 1940 to 1942 he served as chairman of the Faculty.

Professor Breed was co-author, with Professor George L. Hosmer, '97, of a two-volume book on *Principles and Practice of Surveying*. He also wrote a short text on surveying, a surveying instruction manual for the Armed Forces Institute in World War II, several reports on highway costs, and many technical articles. For many years he was a member of the American Society of Civil Engineers, of which he was also a past director. In 1940 he was made an honorary member of the American Society of Civil Engineers, the highest individual honor that the Society bestows. He was a past president of the Boston Society of Civil Engineers and of the New England Railroad Club, national honorary member of Chi Epsilon, honorary member of Tau Beta Pi, and a member of the American Railway Engineering Association, American Road Builders Association, and American Society for Engineering Education. Professor Breed was also a trustee of the Lynn Five Cents Savings Bank.

Second Alumni Fund Conference

■ Approximately 160 Alumni – including Class Agents, Special Gifts Chairmen, Regional Representatives, representatives of various classes – and about a score of members from the Institute's Faculty and staff attended the Second Alumni Fund Conference on Friday and Saturday, September 12 and 13, at M.I.T. where they heard administrative officers discuss M.I.T. plans and policies. Out-of-town registrants were housed at Baker House.

John J. Wilson, '29, President of the Alumni Association, presided at the opening session which was held at the Little Theater in Kresge Auditorium on Friday morning, September 12. Edwin D. Ryer, '20, chairman of the Alumni Fund Board, was moderator for a panel of speakers at this session. Philip A. Stoddard, '40, Vice-Treasurer of the Institute, spoke on the continuing financial needs of M.I.T. Robert M. Kimball, '33, Secretary of the Institute, outlined ways in which Alumni might help to cultivate interest in M.I.T. activities of persons concerned with higher education. Henry B. Kane, '24, Director of the Alumni Fund, reviewed the history of the Alumni Fund and outlined its objectives for the coming years. George P. Wadsworth, '30, Associate Professor of Mathematics, and Alumni Fund consultant, outlined analytical techniques used to study Alumni Fund giving; and the talk by Joseph E. Conrad, Director for Regions and Special Gifts, dealt with the merits of personal solicitation. Finally, Donald P. Severance, '38, Secretary of the Alumni Association, spoke on the relation of Fund activities to other Alumni activities, such as the regional conferences which have been signally successful wherever they have been held in various cities in the United States.

M.I.T. Photos

Enjoying good fellowship at luncheon in the Graduate House on September 12, head table guests were (left to right above): *Donald P. Severance, '38, Secretary-Treasurer of the Alumni Association; John J. Wilson, '29, President of the Association for the current year; George J. Cooke, Jr., Director of the Princeton Alumni Fund and President-Elect of the American Alumni Council; Edwin D. Ryer, '20, Chairman of the Alumni Fund Board; W. Channing Brown, '91, Class Secretary; Miles S. Sherrill, '99; and Henry B. Kane, '24, Director of the Alumni Fund. A Technology beaver, molded in ice* (right) *stands guard over delicacies offered for the Friday evening dinner at Walker Memorial.*

M.I.T. Photo

Head table guests at Walker Memorial included (left to right): Whitworth Ferguson, '22; Avery H. Stanton, '25; Edwin D. Ryer, '20; George J. Cooke, Jr., of Princeton University; James R. Killian, Jr., '26; J. A. Stratton, '23 (at speaker's rostrum); H. B. Richmond, '14; H. E. Lobdell, '17; Raymond Stevens, '17; and Joseph E. Conrad, Director of Regional Fund.

On Friday, luncheon was served at the Campus Room of the Graduate House, with Mr. Ryer presiding. George J. Cooke, Jr., Director of the Princeton Alumni Fund, and President-Elect of the American Alumni Council, was a most welcome guest and inspirational speaker. After reviewing the history of universities and the means by which they had been supported, Mr. Cooke pointed out that American citizens no longer have a free choice in their support of education. If such support is not forthcoming voluntarily, said Mr. Cooke, it will have to be undertaken by the government, and the citizens will have to pay for education one way or another, for education cannot be neglected.

In the afternoon on Friday, meetings of Class Agents were held for the purpose of preparing the first 1959 Fund mailing and for discussing programs of regional solicitation.

Following a social hour at Walker Memorial, where a buffet dinner was served, those attending the conference were fortunate enough to hear James R. Killian, Jr., '26, President of M.I.T., speak on the significant role Technology Alumni played in the recent Atoms for Peace Conference which he had just attended in Geneva.

Mr. Wilson then presented awards to various Alumni who had made significant contributions to the work of the Alumni Fund during the past year. Awards went to:

1. Harold S. Osborne, '08, for leadership in the gift of the Fifty-Year Class;
2. Richard S. Morse, '33, who led his Class to one of the largest 25-Year Class gifts to date;
3. George R. Wadleigh, '97, whose Class achieved 63 per cent participation, the highest of all classes;
4. Edward B. Roberts, '57, whose class achieved the highest participation of any first-year Alumni;
5. Josiah D. Crosby, '21, for his outstanding record of participation in a large region; and
6. Thomas Howitt, Jr., '50, for 100 per cent participation in the Corning Region.

J. A. Stratton, '23, Acting President of the Institute, brought the dinner meeting to a close with an address on challenges facing colleges and universities in meeting the national educational needs. The thoughts expressed by Dr. Stratton were similar to those contained in the President's Report, which is presented in condensed form on page 29 of this issue.

On Saturday morning, September 13, informal meetings were held (1) for Class Agents, at which Mr. Kane presided; and (2) for Special Gifts Chairmen, at which Mr. Conrad presided. Two research developments of current importance were reviewed in the Compton Lecture Hall where D. Reid Weedon, Jr., '41, officiated. Volta W. Torrey, who is M.I.T. Director of Television, J. Halcombe Laning, Jr., '40, Elmer J. Frey, '49, and Milton B. Trageser, '51, presented the results of a study on the feasibility of sending a missile to Mars for photographing this planet. George Bekefi of the staff of the M.I.T. Research Laboratory of Electronics, spoke on gaseous plasmas, indicated the importance of plasma studies in controlling thermonuclear reactions, and conducted visits to the Research Laboratory of Electronics where plasma experiments were demonstrated.

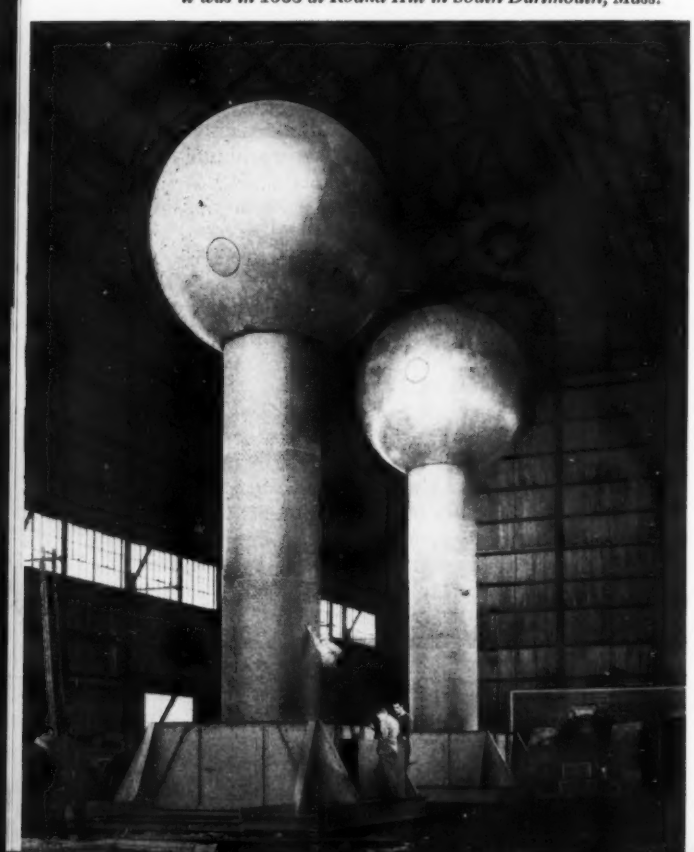
The concluding event of the meeting was luncheon on Saturday, the 13th, at the Faculty Club where Frederick G. Fassett, Jr., Dean of Residence at M.I.T., spoke on the housing problems confronting the Institute. Although the Institute can no longer undertake to provide housing for its married students, a greater number of M.I.T. students than ever before now live in dormitories on the campus or in nearby fraternity houses. Despite a considerable growth in dormitory facilities for students, the demand still exceeds the supply, however. A primary aim of the Institute's Faculty Resident Program — whereby a number of Faculty members live in dormitories occupied by students — is to develop a higher degree of student-Faculty contact for M.I.T. students during their college years.

Twenty-five Years Ago This Month . . .

■ What The Review described as a "mighty siege gun of science" went into action at the M.I.T. Research Station, South Dartmouth, Mass., its purpose being "to batter away at the nucleus of the atom, mysterious and formidable stronghold that has defied man in his march toward an understanding of the material universe. This great instrument of aggression against ignorance is an electrostatic generator producing 10,000,000 volts, a potential far higher than any hitherto accomplished. Conceived by Robert J. Van de Graaff, research associate in the Institute's Department of Physics, and built by many hands, it is ready, with its capacity of 20 or more kilowatts of steady direct current, to hurl missiles of high-voltage ions into the inner atom. . . .

"The Van de Graaff generator has been designed for the purpose of speeding up electrified particles in order to discover the effects which will be produced when they bombard chemical elements of different types. The first proof that this method may be used was found by Drs. J. D. Cockcroft and E. T. S. Walton at Cambridge University, and has since been verified and extended by them and several other workers. The Van de Graaff apparatus will permit such experiments to be extended to much higher voltages than any hitherto employed and to far greater numbers of electrified particles. In this way it may be expected that additional types of atomic disintegration may be discovered and that some of them may be produced on a large scale.

Pictured below is the electrostatic Van de Graaff generator as it was in 1933 at Round Hill in South Dartmouth, Mass.



"In order to carry out these experiments two instruments are necessary: one is a high-voltage generator, . . . the other is a vacuum tube capable of withstanding hitherto unattainable high voltages. . . .

"Until recently nearly all vacuum tubes have been constructed of glass, which has been used up to voltages of about one million. At this voltage, or even less, glass usually breaks. Laminated paper, a great number of layers of thin paper carefully cemented together with shellac under high pressure, is the material being used in construction of the giant vacuum tube designed for the Van de Graaff generator."

■ *Jerome C. Hunsaker*, '12, previously Vice-president of the Goodyear-Zeppelin Corporation, became head of the Department of Mechanical Engineering, succeeding the late *Professor Edward F. Miller, '86; . . . President Karl T. Compton* became chairman of the new Science Advisory Board appointed by President Roosevelt to advise the government on its technical and scientific work; with *Frank B. Jewett, '03*, President of the Bell Telephone Laboratories, as a member of the Board; . . . and *President Compton* also was appointed to the Executive Committee of the Business Advisory and Planning Council of the Department of Commerce, of which Council *Gerard Swope, '95*, President of the General Electric Company, was chairman.

Gold Medal to Dr. Collins

■ For outstanding contributions to low-temperature research and especially to the production of liquid helium, Samuel C. Collins, Director of the Cryogenic Laboratory and Professor of Mechanical Engineering at the Institute, received the Kamerlingh Onnes Gold Medal of the Dutch Society for Refrigeration in Holland on June 24.

The Society has awarded only two Silver Medals in the last 50 years. This is the first Gold Medal, and Dr. Collins is the first American to win recognition from the Society. The award was made at the Onnes Conference for Low Temperature Physics at the International Congress of Natural Sciences in Leiden.

Until the last decade, liquid helium – which boils at —452 degrees (below zero) F. and is very useful in the study of atomic structure and energy in metals – was being produced only in tiny amounts. Through development of an open-circuit expansion engine, Professor Collins made possible industrial production of liquid helium in much larger quantities. For his invention Dr. Collins received the John Price Wetherill Medal of the Franklin Institute in 1951. Dr. Collins designed and built his first helium liquefier at M.I.T. in 1946.

Born in Democrat, Ky., in 1898, Dr. Collins received his B.S.A. and M.S. degrees from the University of Tennessee; his Ph.D. in chemistry from the University of North Carolina in 1927. He joined the staff at M.I.T. in 1930.

On September 3–5, Dr. Collins served as chairman of the 1958 Cryogenic Engineering Conference, held at the Institute, which was attended by 500 engineers from the United States and European countries.

President's Annual Report

Widening gap of intellectual achievement, between high school and graduate professional school students, poses fundamental problem for today's colleges, according to the annual report

by J. A. STRATTON

ALMOST a year ago, Technology's President, James R. Killian, Jr., '26, was asked by President Eisenhower to assume an important assignment in Washington. Dr. Killian's absence from Cambridge has placed additional responsibilities on Chancellor J. A. Stratton, '23, who, last November, assumed the additional post of Acting President of the Institute, as recorded in the December, 1957, issue of The Technology Review.

The meeting of the M.I.T. Corporation on October 6 was the first such assembly calling for an annual report from Dr. Stratton. In recounting M.I.T. progress during the past year, Dr. Stratton's report deals primarily with current problems arising from the Institute's growing obligation to promote excellence in education.

The Institute has constantly pioneered in developing new and more effective curricula for better educating its students. As in the past, leading educational institutions are called upon to investigate and develop frontiers at one end of the intellectual spectrum. Dr. Stratton is keenly conscious that, today, they are also called upon to make substantial contributions to nationwide improvements in education at the level of the secondary schools. The impact of this double-ended responsibility on M.I.T. is ably set forth in this year's annual President's Report.

Those who have witnessed the spectacular growth of the Institute's manifold activities — especially since the end of World War II — realize that the need for effective liaison and improved communications between the various groups of the Technology family is a matter of increasing importance. That this is fully recognized is clearly indicated in Dr. Stratton's remarks that there is "immediate need to convey to the undergraduate a keener sense of belonging, of personal participation in the great enterprise which is M.I.T." for "today's undergraduate feels himself anywhere but at the center of this particular academic universe."

At a time when the nation's educational system is being critically examined for all possible improvements that may be adopted, Dr. Stratton's remarks will be especially pertinent to Review readers. Those portions of Dr. Stratton's report which review events of the past have frequently been reported in the pages of this publication. For this reason, The Review presents here those sections of Dr. Stratton's report which deal with policy matters or with especially newsworthy topics; omitted here are other sections which have already been presented to Review readers in one way or another.

In recounting changes in the past year, Dr. Stratton states:

The most significant event of the academic year 1957-1958 was the appointment last November of Dr. James R. Killian, Jr., '26, as Special Assistant for Science and Technology to the President of the United States. He was called to Washington at a moment when M.I.T. was most in need of his great, constructive energy. But on the larger national scene, his departure reflected a mounting concern for the state of science in this country. It was evidence of a new national awareness that the hopes for our survival as a free and prosperous nation rest in large measure upon the quality of our education and upon our capacity for scientific research.

Political and economic developments of the past decade and particularly those of recent months, have had a profound influence upon the growth and character of the Institute. It is inevitable that we should respond sharply to these great events, for M.I.T. moves in the midstream of modern life. Indeed, the salient quality of our philosophy of education, of the methods and substance of our teaching, and of our attitude toward public responsibility is a sense of direct relevance to the world and to the times in which we live. This relatedness to the world of action as well as to the world of thought brings to us a variety of problems and responsibilities seldom found within the confines of a university. It imparts an intensity to the life of the institution that at times has seemed excessive; in compensation there are but few of us, whether students or Faculty or staff, who fail to respond to the challenge of participating in a great enterprise or who remain unmoved by the sense of excitement that comes with work in the front lines.

M.I.T. has served and will continue to serve the nation effectively in many ways. Members of our Faculty and Administration have made countless personal contributions to the public interest — many of them at a sacrifice to professional advancement. Theirs is a superb record of achievement and public spirit. Laboratories such as Instrumentation and Lincoln are playing a key role in the development of an adequate national defense. The Schools of Science and Engineering have made notable additions to our understanding of the basic laws and processes of the physical world, and are pursuing imaginative explorations of their application.

Toward Excellence in Education

Public service, defense research, and the broad advancement of scientific knowledge are essential parts of the total mission of M.I.T. But we bear ever in mind that our first obligation, our foremost concern, must be

for the education of our students. If there is any one thing which events of the past year have made clear, it is the imperative need to augment the corps of highly educated men and women in the United States. This need is apparent in every field of professional endeavor. Nowhere is it more critical than in science and engineering. The quality and fruitfulness of American research through the coming decades, the character of industrial statesmanship a generation hence, will be determined by the wisdom and effort we show now in the education of our youth. M.I.T., in the years ahead, can hope to supply only a diminishing fraction of the total number of scientists and engineers essential for the political and economic security of this country, for no private university can keep pace in its growth with this expanding need. There rests upon such institutions as ours, however, a heavy responsibility to provide highest standards of excellence. to set new patterns, to give leadership, and to lift the sights of all.

Four Years to Span a Gulf

The most fundamental problem, and the most difficult with which to cope, is the widening gap between the mean level of academic achievement in the average American secondary school on the one hand and the intellectual maturity of our top graduate professional schools on the other. For at least 30 years, the foremost departments of science and engineering in the United States have compared favorably at the graduate level with the best to be found in Europe. But we can make no such claim for our high schools. This is the gulf that must be bridged in the brief span of four undergraduate years.

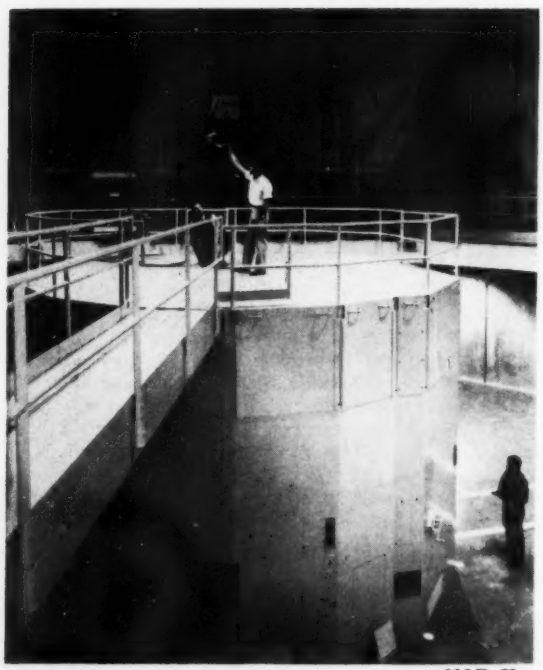
For an extended period of our national development this discrepancy had no serious consequence. Relatively few undergraduates chose science as a profession; and among those who did, a considerable number supplemented their basic training with advanced study abroad. With a few notable exceptions, serious research and development in industry, as currently conceived, were unknown. The basic engineering needs of the country could be met by four-year college graduates with a good grasp of physics, chemistry, and elementary calculus to bolster their professional subjects and shop practice. But World War II and the more recent political developments abroad have brought to light our urgent need for scientists and engineers with a complete command of all the knowledge and techniques necessary to advance science and to exploit it to the utmost for our own use.

As a consequence, the task of bringing even the most talented undergraduate student, in four years, to such a point of intellectual maturity that he may deal effectively either with the requirements of the top-rate graduate school or with the pressures of modern industry, is a geat and difficult one.

But the need is also great, and the country looks to M.I.T. and to its sister institutions for leadership.

The basic step toward alleviating some of the pressures on undergraduates in professional schools must eventually be taken within the high schools themselves, and our colleges should join forces in a national effort to lift the levels of achievement in elementary science and mathematics. In this connection, the Institute can be particularly proud of the contributions being made to the teaching of high school physics by the Physical Science Study Project, under Professor Jerrold R. Zacharias.

Realistically, however, it may be many years before we can count upon the kind of rigorous training in our secondary schools that is expected of every candidate for admission to a French, German, or Russian technical institute or university. In the interim, we must accept the preparation of the entering freshman as it in fact is. Our task is to develop his confidence as well as his competence and to feed the flame of his interest as he masters the fundamentals.



M.I.T. Photo

The first privately owned heavy water reactor in the United States was put into operation at M.I.T. during the summer. It will furnish nuclear particles and radioactive materials for research in medicine and industry, and in the basic sciences.

Toward Independence and Responsibility

The plight of the average undergraduate in any first-class technical school is further aggravated by the fact that he usually expects the same spoon-feeding system of education that marked his secondary schooling. He needs time to understand that from now on he must be his own teacher. It is the true function of a university to inspire the student; to provide him with abundant examples of significant scholarship; to counsel him on the direction and progress of his studies; to furnish him with the most ample resources of library and laboratory; and to afford him the incalculable benefit of intimate association with first-class minds.

The typical entering freshman at M.I.T. is far from ready to cope with such a mature concept of learning. The transition at best is certain to be painful, but we must keep steadfast our aim to help each individual student achieve as easily and rapidly as possible his highest intellectual potential and to develop fully his capacity to pursue a free and independent way.

Finally, in our assessment of undergraduate life at M.I.T., we must take account of the fact that the Institute itself is evolving rapidly into a new kind of university. There was a time, not so many years ago, that our activities were centered almost exclusively in undergraduate education. This is no longer true; today's undergraduate feels himself anywhere but at the center of this particular academic universe. Almost daily in the press he reads accounts of Institute activities in which he has had no part—which he may even assume are entirely foreign to his own interests. He learns of celebrated pro-

fessors who are members of our Faculty but whom he has not yet met, and he feels that he has missed a fair share of his educational experience. And finally, for many a freshman, a most serious disorienting factor is the discovery that instead of being at the top of his class in a local high school, he is now only one among many exceptionally able students.

These are some of the basic conditions that temper the environment of our undergraduates, conditions which we must deal with realistically if we are to strengthen our educational base. Here M.I.T. has, I am convinced, not only an overriding responsibility but also an extraordinary opportunity.

A Richer Community Experience

This year there have been many new plans and new experiments designed to improve the effectiveness of instruction in many departments. This is a never ending task, and the Institute must be prepared to devote substantial resources to research in teaching and to the development of our undergraduate laboratories. There is much still to be done to stimulate interest in the teaching problem and to reward those who teach with skill and devotion.

But while these measures are important, I think that there is an even more immediate need to convey to the undergraduate a keener sense of belonging, of personal participation in the great enterprise which is M.I.T. A year ago, Dr. Edwin H. Land dealt with this problem in his stimulating and provocative Arthur D. Little Lecture. A variety of interesting projects are being discussed by members of our Faculty, all with the common aim of bringing undergraduates into association sooner with the senior members of our academic community. It is my sincere hope that these ideals will bear fruit.

As a corollary to these developments in classrooms and laboratories, we must take steps to enrich the campus life beyond the provision of bed, roof, and board. The residential program ought to make a major contribution to the intellectual and moral development of all students; and it can, aided by those activities, cultural and otherwise, which do so much to make college life a memorable experience.

Two Views of Engineering Education

Among the current discussions of educational policy at the Institute, none is more complex nor more important than that dealing with trends in engineering education. The issues involved are of fundamental significance, as any action M.I.T. ultimately takes to resolve them will largely determine the Institute's future character and set an example which may affect materially the course of engineering education in the United States.

There are two basic positions. I am tempted to refer to them as the liberal, or radical, and the conservative. These designations are neither quite accurate nor perhaps entirely fair to the respective protagonists, but they are convenient for our present purpose. There are also, of course, a number of people in the middle, or "independents."

The extreme liberal party contends that the traditional curricula of engineering schools are essentially obsolete. They point out that industry itself has passed beyond the stage of simple technology and into a domain of enormously complex problems. As we all know, the industrial importance of research and development has been vastly enhanced. But wholly apart from the laboratory, the engineer today has to deal with a wide range of subjects, which may include such diverse fields as materials, fluid flow, combustion, or information theories. Whatever it may be, he is unlikely to make important contributions in these areas without the benefit of fundamental and thorough training in physics, chemistry, and mathematics.

As a consequence, no one disputes the new status of research in industry or the need to enlarge the professional group of applied scientists competently trained to work on these new frontiers. The real question at issue is whether or not M.I.T. may be shaping its undergraduate curriculum too strongly in this direction, to the disadvantage of other facets of the engineering profession taken in its entirety. Specifically, how far should we go in discarding all the drafting and design, the shop, and the more practical, immediately useful professional subjects?

On this question our liberal friends argue that the whole broad field of technology is now advancing at such an accelerating pace that the best undergraduate education in engineering will steep the student in basic science and in the true fundamentals of his future profession, leaving him free to decide after his bachelor's degree whether to pursue a career in research, development, design, or industrial management. On this hypothesis an undergraduate curriculum in engineering, centered increasingly in science, mathematics, the basic professional subjects, and the humanities, would approach more nearly the counterpart of liberal education which is the foundation of the professions of medicine and law.

But against this argument our conservative wing—and this includes many of our Alumni as well as some of the most thoughtful members of our Faculty—raises certain serious objections. Granted that engineering rests squarely on science and mathematics, the function of the engineer in society nonetheless differs profoundly from that of the pure scientist. The engineer outside the research laboratory experiences a very different relation to his client or to his firm. He is invested with a different kind of responsibility. He is called upon for a variety of judgments and decisions that are normally foreign to the affairs of scientists. At every point his thinking is tempered by questions of cost and reliability and the problems of maintenance and replacement. These modes of thinking and working, quite different from the methods used to solve differential questions, must be instilled in the student at the earliest possible stage of his development. These are the attributes that will distinguish the builders of industry in the future, even as they have in the past.

The apparently easy way to resolve these contending views is to say that the country needs both types of leaders—the applied scientist, and the more empirical engineer. In this belief, many engineering schools within the past few years have introduced a new curriculum designated, for lack of a better term, as "engineering science." M.I.T. itself has undertaken its share of experimentation in this area. The Department of Electrical Engineering, for example, has instituted a Course, Electrical Science and Engineering, which has a strong emphasis on physics and mathematics; and several other departments have plans for comparable options. An *ad hoc* committee on engineering education has also considered the desirability of experimenting with an entirely new course in engineering science distinct from our existing departments.

However, the more deeply one delves into these difficult questions, the more elusive the answers appear, the less easy their resolution. There is a serious objection, for example, to concentrating a faculty of applied science in a single new department, for this concentration obviously must take place at the expense of our present fields of specialization. Doubts also have been expressed as to whether, in the long run, parallel options—one centered

in applied science and the other expressing the more traditional approach to engineering education—can successfully coexist with one another in a single department.

And there are even more critical questions for the long-range future of M.I.T. What effect, for example, will an increasing emphasis upon mathematical ability have upon the character and quality of the students admitted to our freshman class? Have we unwittingly engaged in a selective process that may work to the ultimate disadvantage of the engineering profession itself?

Clearly these issues in engineering education are of consuming importance, both to M.I.T. and the country. Clearly they are difficult to resolve. It is reassuring, therefore, to observe the vigor and insight with which our engineering faculty is attacking them.

The Year In Review

From a long list of notable achievements, changes, and events of the past year, I select the following for special mention:

Some Educational Advances and Opportunities

1. To meet the changing needs of our technological society, there has been at the Institute this year, as I have described earlier in my Report, a ferment of re-examination and experimentation with the educational program in all schools.

In the School of Engineering, the Faculty Committee on Engineering Education has continued its comprehensive review of our various undergraduate curricula. Some of the areas being studied are: the factors determining a student's choice of an engineering profession, the possibilities of a tutorial system, the replacement of requirements with electives in the last two years, and better opportunities for the gifted student to do independent research. In addition, two separate committees are now also evaluating the role of applied science in engineering education and in the general field of materials, both in teaching and research. These are studies of first-order importance.

In the School of Science, the trend towards flexibility is reflected in modifications of several undergraduate curricula. The Biology Department has broadened the scope of its subjects in biophysics to make them suitable for all science majors. The Mathematics Department has made a thorough reorganization of its course offerings in order to furnish stronger mathematical training for engineers and scientists who are continuing beyond the normal three-semester sequence in calculus. The Meteorology Department is providing needed integration between theoretical and experimental aspects of meteorological study, particularly regarding the possibilities of large-scale control of weather and climate. The Physics Department has devoted major efforts to improving its undergraduate program in order to provide better training, not only for engineers and scientists, but also for those students who want to enter the teaching profession at either the high school or college level.

The School of Industrial Management has continued to enrich its curriculum so that all its students – ranging from the beginning students in management in the Undergraduate Program to the corporate officers in the Senior Executive Program – have intimate contact with the applications of science and engineering to the many complex elements of modern management. The use of high-speed computers, emphasis on economic forecasting, study of policy determinants, evaluation of various factors in the control and direction of finance, and a deeper understanding of society and man himself are only some of the major areas in which research and teaching are now being undertaken by the School.

The Faculty and Corporation have authorized the awarding of the degree of doctor of philosophy in City and Regional Planning. Graduate and advanced study in this important field was greatly enhanced by the establishment during the year of the Center for Regional and Urban Studies, under the direction of Professor Lloyd Rodwin. Research will focus upon the physical environment of cities and regions, the forces that shape them, and the interrelationships between urbanization and society.

In the School of Humanities and Social Studies, the authorization to award the degree of doctor of philosophy in Political Science will open the way for advanced work in such important areas as national security, military technology, and public administration, areas in which the Institute offers unique opportunities for study. M.I.T.'s program in political science is based on a dual recognition: political developments today are heavily influenced by technology; and educated man, regardless of profession, must become more familiar with public policy questions.

It is generally agreed that Americans today must seek an improvement, too, in their ability to use and to understand foreign languages. To help meet this critical need, the Department of Modern Languages has expanded its program in Russian, German, and French language and literature. There is increased emphasis upon the spoken word rather than upon grammar and translation.

2. The activities in nuclear engineering, which until now have been a part of the Chemical Engineering Department, were organized during the year into a graduate Nuclear Engineering Department under the direction of Professor Manson Benedict, '32. While reactor technology and fission now dominate the program, the new group is already active in fusion and thermonuclear reactions. The unfolding activities here and in the related field of gas dynamics will bring together in a joint undertaking several of the departments of both the School of Engineering and the School of Science.

3. During the past year we have established a Center for Communications Sciences, to engage in research in the broad field involving the processing and transmission of information in both man-made and living systems. By providing basic research through collaborative efforts between mathematicians, electrical engineers, physicists, linguists, psychologists, physiologists, and others, we will be able to make notable advances in this challenging area of information theory pioneered by such M.I.T. scientists as Vannevar Bush, '16, and Norbert Wiener.

4. The Physical Science Study Project, under the direction of Professor Zacharias assisted by Professor Francis L. Friedman, '49, has continued to expand its work in planning a new approach to the teaching of physics in the secondary schools. During the summer of 1958, some 350 additional teachers were trained in the aims and methods of this new curriculum, and it is expected that some 12,000 students will be taught the new program this year. Negotiations have been completed to transfer, with the assistance of the National Academy of Sciences, the Institute's major administrative responsibility for the project to Educational Services, Inc., a nonprofit corporation.

5. After a comprehensive study, the Faculty has voted to modify the compulsory first two years of Reserve Officers' Training Corps, beginning with the Class of 1962. This action places all military training at the Institute on a voluntary basis and should produce a better qualified and more enthusiastic corps of reserve officer trainees.

6. The Computation Center, made possible by the International Business Machines Corporation, completed

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U. S. Progress
IN SCIENCE AND EDUCATION

Whatever our major national goals may be, the first essential is to achieve better education, better science, better technology. This requires improvement of quality in education and performance.

by ALAN T. WATERMAN

Now that a year has elapsed since the launching of the Russian satellites, when this country was dramatically brought face to face with the need for critical examination of its national effort in science and technology, it is appropriate to consider our progress and to gauge the follow-through of President Eisenhower's stirring and realistic messages to the country of last November 7.

In particular, attention has been directed to the urgent need for developing to the fullest our capabilities in science and engineering research and our education and training in science and engineering.

Some notable progress has been made and some major accomplishments undertaken. President Eisenhower's appointment of James R. Killian, Jr., '26, as Special Assistant for Science and Technology, backed by a distinguished Science Advisory Committee, has been widely acclaimed. The President has approved an education bill which constitutes a forward-looking move to assist in the improvement of our system of education. Initial steps were taken with respect to federal support of basic research, and plans have materialized for the formation of a new agency, the National Aeronautics and Space Agency, to deal with the urgent problem of space research and exploration. Military research and technology have received increased emphasis in keeping with current national defense goals. The President has proposed plans for reorganization of the Department of Defense designed to improve materially the effectiveness of our military potential.

The government has taken these constructive steps. It is now fair to ask: are these enough? Are we as a nation proceeding forthrightly to accomplish what is necessary for maximum progress in science, technology and for the improvement in the education and training of our young people? Furthermore, are we acting with the promptness which the situation demands? Or is there evidence that, as a rebound from our intense interest of last fall, we are in danger of again becoming complacent? As a single illustration, one need only compare the reaction of the public to the launching of the first sputnik with that manifested at the third launching in May.

The answer is that we have only made a beginning: the major job is still to be done. In the field of education, there seems to be no immediate prospect of adequate salaries for school teachers, of adequate school buildings and facilities, nor of adequate incentives for recruiting the numbers of competent teachers we shall require. Congress shows caution about taking action, as do most of the states; the scientific and educational societies lack funds; and local attempts, outside of a few wealthy suburban communities, have come up against the realization that adequate funds are not available for the purpose until something is done about taxes.

As for the support of scientific research, it is generally recognized that the modern dependence of a country upon its technology requires thorough attention to its progress in science. The key to the latter lies in the support of basic research. Forward thinking and plans for dealing with important areas of research have not as yet shown indication of full realization in budget terms. The immediacy here lies in insuring the health and strength of science and engineering in the graduate schools of our colleges and universities, which constitute the stronghold for basic research and for the advanced training of scientists and engineers. The pressing problem for science and engineering in universities is to secure modern laboratories and research equipment, including rather costly equipment for the larger institutions, and to provide for large capital research facilities to be used nationally or at regional centers. In the interest of training future scientists, needs extend to undergraduate laboratories and demonstration equipment. Not to be forgotten are the fundamental needs of our colleges and universities for funds freely usable for maintenance and operation; these are the most difficult of all to secure.

In the meantime, the evidence from other countries and notably the U.S.S.R. shows a determination and a national spirit on the part of the people which seems to be relatively absent from the American scene. The recent educational group which went to the U.S.S.R., under the Commissioner of Education, and likewise the group of university presidents, came away with the conviction that the Russian people see their way clear to world leadership in science and technology. They are apparently dedicated to this – not in the sense of military competition but rather of achieving world supremacy without the need of military domination. Among other nations, we shall ultimately have to reckon with the genius for organization and the industry of the German people, the industry and learning ability of the Japanese, and the industry and potentialities of the Chinese.

We appear to forget that as a nation we live in a competitive world and shall continue to do so. It seems abundantly clear that we shall rapidly lose in

competition, unless we can show more determined and constructive efforts than during the past years.

It is clear that success in the requisite effort depends fundamentally upon the understanding of the problem by our people and our determination to achieve these goals. Under our democratic system, no segment of government, whether federal, state or local, can succeed in securing necessary action programs or funds to carry them out unless our citizens understand, actively endorse, and indeed participate in the steps that need to be taken. In short, the wholehearted co-operation of the people of the country is necessary to achieve the goals which the President has pointed out so clearly. Most important here is a realization that this is not a single emergency but a continuing – possibly a permanent – one. In this modern world there can be no relaxation of our determination to compete successfully and continuously.

Admittedly these questions are complicated by several issues: (a) the need and extent to which the federal government should take action and provide funds for education and for educational institutions in the face of a traditional policy of leaving such matters to state and local authorities; (b) the development of our full capabilities for national security and world competition without jeopardizing our economy; (c) the realization of national goals while maintaining individual initiative and achievement of individual wants and ambitions; (d) attainment of full development of individual talents and aptitudes while dealing satisfactorily with the demands for education for all.

While these questions are important and should be resolved, we dare not allow these to becloud the main issue: we must progress in our science and technology and in the education and training of our citizens with all the effectiveness and thoroughness we can muster. We cannot afford to delay in arguments as to how we do them.

During the past year the recession has brought us face to face with one of our most serious difficulties (b. above), namely, how we can develop our full capabilities and still remain financially solvent; in other words, how to provide for the increasingly costly technological developments necessary for national security without endangering the nation's economy. A grave danger here is that, for reasons of economy, we fall short of developing our capabilities in science and technology.

We can only insure the possibility of full protection of national security by giving every encouragement to scientific research (as contrasted with development and production). It is only in this way that we can achieve the ideas and the breakthroughs which promise clear superiority: it is only in this way we can insure that the developments we undertake are modern and up-to-date in every detail. The results of such research, in competent hands, are never without value. Even when no breakthroughs appear, the total effort always brings a possible breakthrough closer.

It should be noted that the costs of research are very small as compared with those of development. Only about 4 per cent of national funds for research and development go into basic research.

As history amply records, the most epoch-making scientific discoveries have come from basic research. But basic research, being exploration into the unknown, by its very nature cannot predict exactly where these breakthroughs will occur. Therefore, comprehensive support of research has to be undertaken in order to overlook no opportunities. This should be regarded as an investment, the precise spots where high returns occur being unknown in advance. With full support of research, both basic and applied, we then have full exploitation of the potentialities for development and production. Inciden-

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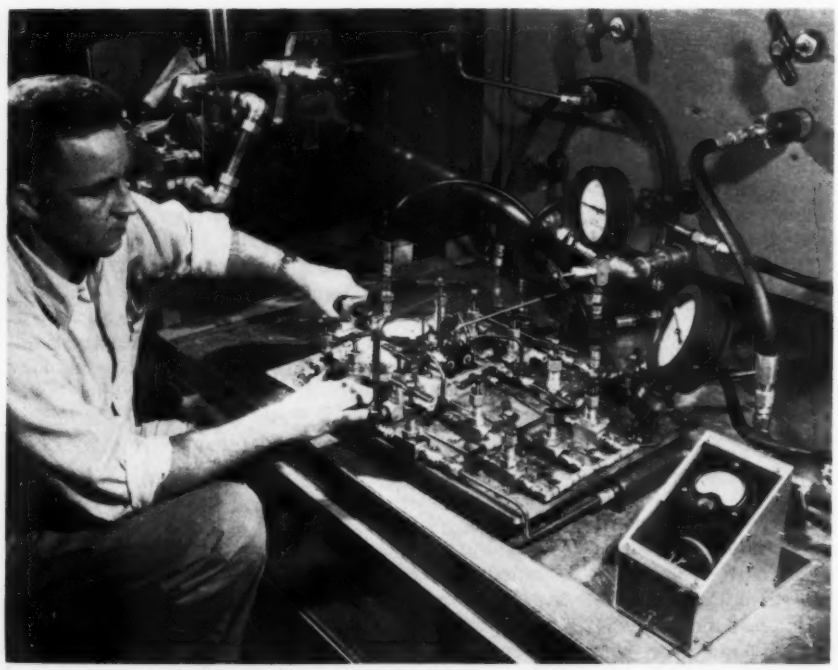

The close interrelationship and interdependence of various kinds of engineering (as represented, for example, in servomechanisms or systems engineering) emphasizes Dr. Waterman's view that "The pressing problem for science and engineering in universities is to secure modern laboratories and research equipment, including rather costly equipment for the larger institutions, and to provide for large capital research facilities to be used nationally or at regional centers."

M.I.T. Photo

On Tour with the M.I.T. Choral Society

Approximately 75 members of the M.I.T. Family, touring a dozen European cities, demonstrate that science and the arts can go hand in hand

by ALICE JEGHELIAN

AMONG the many groups who toured Europe this summer for every reason from simple sightseeing to collecting butterflies, the European concert tour of the M.I.T. Choral Society slips by almost unnoticed. Yet the particular experience enjoyed by this group of young men and women is unique, not only compared to that of the ordinary American tourist but also to the several other American groups traveling under some sort of musical aegis, either professional or amateur. Its story is worth noting.

The M.I.T. Choral Society is not a college glee club, though it bears the name of the Massachusetts Institute of Technology. Its membership comprises a cross section of the entire Institute "family." Members' ages vary from 18 to 48. Members' incomes begin in the minus category. Students, scientists, engineers, instructors, technicians, secretaries, student wives, altogether numbering some 125 people (approximately half of whom made up the European contingent) – with at least two things in common – M.I.T. and a passion for choral singing: This is the M.I.T. Choral Society founded and directed by Klaus Liepmann, Professor of Music at M.I.T.

To organize a group of this size for a trip to Europe is a big job. To arrange a concert tour also is something short of a Herculean task and at best a full-time occupation for one person. W. Paul Jensen, '50, one of the basses, managed to do it in addition to his own job as engineer and research associate in the Department of Chemical Engineering at the Institute.

Financing the trip also fell on the chorus itself. Contrary to common assumption, the expenses were met almost completely by the individual contributions of each member and by group fund-raising efforts such as sponsoring concerts, and so on. For months Miss Alison King, an alto in the chorus and treasurer for the trip, kept painful track of the bank balance as it slowly crept toward the desired goal. The budget was modest and, relatively speaking, skimpy. The Choral Society's tour would not be a luxury one!

But what it lacked in cash it more than made up in another negotiable item – good music. When the chorus boarded its chartered B.O.A.C. airplane on the evening of July 2, 1958, each member carried with him no less than five pounds of music. This impressive package (besides consuming a substantial portion of the 44-pound airplane baggage allowance) contained a repertory unlike that of any college glee club. Included were the classical masterpieces, *Magnificat* by Bach, *St. Theresa Mass* by Haydn, more modern selections like Honegger's *King David* and Copland's *In The Beginning*, and other contemporary pieces such as Büchtger's *Auferstehung nach Matthäus*, Ives' eight-part *67th Psalm*, Hovhaness' *Transfiguration*, and Finney's *Pilgrim Psalms*. This is a repertory both challenging in depth and variety, and certainly rich fare for the listener.

Thus on Wednesday evening, July 2, 60 members of the M.I.T. Choral Society, a few nonsinging husbands and wives, their conductor Professor Liepmann, and his singing wife, a number of children (as yet nonsinging), and four soloists – Catherine Rowe, soprano, Margaret Tobias, alto, Donald Sullivan, tenor, and Paul Matthen, bass – took off from Logan Airport for Paris. It was an economy flight, but the choristers were accustomed to crowded onstage conditions. When one of the airplane's superchargers failed to operate the air conditioning, the people in front simply moved back to visit with their friends in the air-conditioned rear until an alarmed stewardess begged them to return to their seats as the airplane was getting off balance. At this point no one minded. Spirits were high for more reasons than the champagne toast that had been served earlier (compliments of the travel agent).

Eighteen hours (mostly sleepless) and countless games of bridge later, the chartered airplane landed in Paris. Here the concert tour was to begin, with two concerts scheduled for Tuesday and Wednesday of the following week: one at the St. Eustache Church (one of the oldest churches in Paris, famous for its excellent music); and the second at the American Church on the Quai D'Orsay. There were daily rehearsals at the Paris Conservatory of Music with the conservatory orchestra, and there were periods of enforced rest before each concert. When the American Church unexpectedly invited the chorus to sing at Sunday morning service, this too was fitted into the schedule.

Meanwhile, the group got settled in their bargain hotels – some five or six little establishments in the heart of the Latin Quarter near the Sorbonne. For approximately $1.80 a night (a marvelous figure for the Choral Society's coffers!) one had a room plus

breakfast. Of course, for that price one doesn't expect to find an elevator – especially in a five- or six-story building. And if the beds feel damp, "eet ees only because the blankets have just been washed, monsieur." The 30 single women who were assigned most unimaginatively, they claim) to one hotel now tell how the building was plunged into darkness three times in a row the evening they arrived. One alto says the porter blew out a fuse as he tinkered with a lamp in her room. The others are more inclined to believe that the sudden, unaccustomed use of all the electricity in all the rooms at once was too much for the ancient wiring. Baths also became a rarity, since none of these structures boasted more than one bathtub (if any) and that was usually hidden behind two locked, unmarked doors. This, in a way, is the saga of the bathless singers!

While countless Americans have, in the past, seen Paris from their first- and second-class tours, it is quite again another thing to catch your first glimpse of Notre Dame as you hang onto a strap of a rickety old bus crowded with commuters from the Boulevard St. Michel or *Boulemiche* as it is known to the students. This was the Choral Society's kaleidoscopic introduction to the city as they dashed off in the mornings to rehearsal at the Paris Conservatory. No one dreamed of taking a cab, for by now the mysteries of the metro and bus systems had become common knowledge. On their free time the singers roamed at will all over the city. Some rented bikes. Others went on picnics. One tenor spent most of his time in the American Consulate tracing a lost passport. And there were parties with the students of the French orchestra.

It was off season for concerts in Paris. Even André Marchal, the well-known blind organist at St. Eustache, upon whose personal invitation the Choral Society first began making plans for a European tour, was not optimistic about the size of audience that could be expected. Concert night proved otherwise. The huge center section of St. Eustache was filled to capacity. The singers, tense and silent, waited for Professor Liepmann to take his place before them. A sudden hush in the audience prefaced his appearance. The singers watched. As their voices lifted for the first time within the lofty interior of the beautiful old church, the thrill of that moment and of the whole trip came upon them.

A church audience and its reactions are very difficult to judge. In addition to the two church concerts in Paris, the Choral Society was slated to appear twice more in churches – the Abteikirche in Amorbach, Germany, and the small church in Weikersheim, Germany. But singers experienced in church music know that an audible applause is not the only means of judging their work. The expression on an old woman's face, the alert, expectant eyes of two students sitting in the front row, the peaceful composure of an elderly, mustachioed gentleman as he sits with both hands folded on his cane before him, the half-smile of a plump woman in a faded sweater, the enrapt silence of a small child, a young couple oblivious of each other – all these are weather vanes to the sensitive eyes of a singer.

For the M.I.T. Choral Society, St. Eustache was just the beginning. Here the results of many months of preparation and the impact of the message they were imparting were first realized. One didn't need to understand French or German or English to know what a listener meant when he warmly shook a singer's hand after a concert. This feeling was prevalent everywhere the chorus went. In an excellent review of the Choral Society's concert in Amorbach the *Rhein-Neckar-Zeitung* wrote: "In order to further German-American cultural relations, no better agent could have been commissioned than this 60-voice choir from the most important institute of technology of the U.S.A."

Paris will always hold special memories for the Choral Society. One of the most significant will be the telegram from Mme. Andrée Honegger, widow of the composer. On the eve of the choir's first performance of *King David* she wired her regrets that she could not be there, at the same time expressing her deep appreciation of the event. Also among the group's special souvenirs will be their first European "fan letter" in the form of a calling card from a distinguished French musician declaring her "profound admiration" for the Choral Society's two Paris concerts.

Moving days for the chorus were always incredible events. Like everything else, this, too, was a "do it yourself" operation. Busses were hired, whole coaches on trains were reserved, and the most efficient porters on the railroads those days were none other than the tenors and basses of the M.I.T. Choral Society. Whenever a train stopped, women were hurried off first. Then, thanks to the design of a European railroad coach, every window on the platform side of the car was magically open and within seconds all of the baggage for some 70-odd people had come spewing out of the windows onto the platform. The last such event was clocked at 40 seconds!

The ambition of many American musical groups this past year has been to sing in the American Pavilion at the World's Fair. For the Choral Society it became a reality. In this respect it was a success. The Paris Conservatory Orchestra accompanied the chorus to Brussels. Days of rehearsal in Paris had whipped into final shape the program for presentation at the World's Fair the next day. After the long day's trip from Paris to Brussels, both chorus and orchestra were housed in the sprawling "Motel Expo" on the outskirts of the city, which was built especially for the World's Fair and where every unit, appropriately named after a composer, housed some 500 guests. Here the singers were delighted to find showers (one for each wing of only 50 people), and while the orchestra went off for an evening's spree at the Fair, the chorus spent their "enforced rest" waiting in line for the luxuries of this modern convenience.

The next morning found chorus and orchestra arriving early at the Fair Grounds and hustled into the American Auditorium for rehearsal. The concert that afternoon was one of the strangest experiences the Choral Society has ever had. After each piece on the program, a large number of people in the audience

Architectural beauty of the pylon of one of the Institute's main group of buildings in the Great Court compares favorably with the glimpses of European architecture noted by members of the M.I.T. Choral Society while on concert tour on the continent last July. Welles Bosworth, '89, architect of the M.I.T. buildings constructed in 1916, has long been a resident of France.

would get up and leave, and an equally large number would come floating in, quite casually. Even a pause in the middle of a piece was not sacred. The singers confess that never before have they sung to such an amorphous, fluctuating audience. They now feel that they have not performed at the World's Fair but have been exhibited there for the quick perusal of the hurried visitor.

But Brussels, too, had its satisfactions in other ways. The Belgian Consul in Boston and his wife, Mr. and Mrs. Albert Navez, who were in Brussels at the time, personally welcomed the chorus when it arrived at the Brussels railroad station. The sincerity, friendliness, and hospitality of this couple will long be remembered in the hearts of the singers. Finally, one complete but at best frustrating day at the World's Fair, topped by a heavy downpour of rain, brought the Choral Society's sojourn in Brussels to an abrupt and soggy end.

Arriving in Germany was like going back home for many of the singers who, two years before, had spent three weeks there on the Choral Society's first European concert tour. Hamburg, Darmstadt, Amorbach, Rothenburg, Weikersheim, Munich – each stopover a unique and stirring experience. In Hamburg, 40 of the most hale and hearty singers were put up in a hostel about one hour's ride outside the city. Here the third chapter in the saga of the bath was written. The singers bunked 10 in a room. What passed for a shower under the circumstances was in reality a footbath with a very low spout! It was fairly simple to get 10 people in a room containing five double-decker bunks. The real problem was what to do with all the baggage, since there was virtually no space to hang up clothes, and people literally had to live out of their suitcases. Here, too, the singers discovered the typical hostel-type bed linen – that is, a "reversed-double-envelope" sheet approximately in the form of a sleeping bag. You crawled into the larger envelope, and the pillow was tucked into the other. This was unfortunate if you happened to be tall!

For the Choral Society the many highlights in Hamburg ran from one extreme to another. One day they attended a formal reception held in their honor by the Minister of Culture in Hamburg. The next day they did the town on the "Reeperbahn," Hamburg's district of bright lights, night clubs, and girlie shows. The reception took place in the city's historic Town Hall (*Rathaus*) where the Minister, acting as the Mayor's Deputy, personally shook hands with each singer and then in a short, extremely cordial speech expressed his appreciation of the work these young people were doing and its significance in international relations. That evening the Minister had a front row seat at the concert.

The Hamburg Radio Orchestra accompanied the chorus. It was an excellent ensemble of professional musicians with whom the singers were very proud to work. The concert took place in the auditorium of the Hamburg Radio Station, a hall quite different from any the Choral Society had ever used. The audience seats rose up sharply on three sides of the stage – which was really not a stage but a platform. A variety of unused radio equipment hung precariously above it, and a large radio sound box provided an unusual setting in the rear. By this time, however, the choir had quickly learned to adapt itself easily to any singing conditions.

Pylon at entrance to Building 3 – facing the Great Court – a part of the main group of the Institute's buildings.

A morning spent in a recording session wound up the Choral Society's stay in Hamburg. Once more a mass moving operation by bus and train transported the large group on a day's trip southward to Darmstadt. This was the first in a series of three concerts arranged for the Choral Society by a young German student whom they had met two years ago. The singers will never forget him – Gerd Miedel, engineer, violinist, booking-agent par excellence, and friend. At Darmstadt, the chorus from the best technical school in the United States had an informal reunion with the orchestra from the best technical school in Germany – the Darmstadt Technische Hochschule, with whom they had given concerts two years earlier. Here the concert took place in the school auditorium, the same hall where one alto remembers having met "George," a handsome second-violinist who, she learned to her dismay, had since received his diploma and was employed in Berlin.

The second concert in the Gerd Miedel circuit was in Amorbach. Amorbach is a small, picturesque town, which, for all its humble size and rusticity, boasts two big churches. One of these is the Abteikirche, perhaps the most beautiful example of baroque art and architecture in all of Germany. To have the opportunity to enter this unbelievable spot, much less to sing in it, is good fortune in itself. The M.I.T. Choral Society was doubly fortunate. It must also have been inspired, for the concert performed here, with an extremely difficult, all *a capella* program, was one of the best on the tour and received outstanding reviews, two of which are excerpted here. From the write-up in the *Bote vom Unter-Main*, July 22, 1958: ". . . What this chorus of the largest American institute of technology achieved was excellent to such an extent that it would be difficult to name another chorus of equal quality." From the *Aschaffenburger Volksblatt*, July 22, 1958: ". . . A homogeneous, full and rich choral sound (was combined) with purest intonation; most subtle dynamics with exquisite phrasing; and clearest transparency of polyphonic texture with delightful harmonic sonorities. . . . A kind of music-making which one experiences only with the very greatest of musical organizations."

Rothenburg-Weikersheim, next stop on the schedule. While staying and rehearsing in Rothenburg, the Choral Society commuted to Weikersheim for its next-to-the-last concert. Again the program was all *a capella* and an encore of the success of Amorbach. The small Weikersheim church was filled, literally to the rafters, with people even peeking out from behind the organ pipes! Sitting in the audience that night was the Prince (related by marriage to Queen Elizabeth) and owner of the impressive Weikersheim Castle which the chorus had visited earlier on a private tour. It was a very young castle or *Schloss* as castles go, being only some 200 or 300 years old, but entirely satisfactory to the wide-eyed singer.

The Choral Society was now approaching the climax of its 1958 tour – Munich and a concert for the choral program of the city's 800th-year anniversary festival. At any other time, Munich would have attractions enough to hold its own. It has justly been called the "Paris of Germany." Add to this the color, the crowd, and the pageantry of a huge birthday celebration and you have the setting in which the Choral Society's most important concert was to take place.

It was, to begin with, an honor to be invited to participate in the festivities. The invitation had been extended to Professor Liepmann and the chorus by Herr Fritz Büchtger, one of the foremost German composers on the musical scene today. It was only fitting that a number on the Choral Society's program should be Büchtger's own *Auferstehung nach Matthäus*.

In Munich the chorus was treated as guests of the city. Hotels with breakfast and daily meals at a nearby restaurant were provided. The restaurant turned out to be the Schelling Salon which has a reputation for its substantial and typically German fare. To their surprise, the singers discovered that in an attempt to please their American guests the restaurant was serving what it considered to be American-style meals. The attempt was well meant, even if the end result was questionable.

The concert was scheduled for Saturday, July 26. During the four days preceding the event, the chorus rehearsed regularly. When they met for the first time with the Graunke Orchestra, which was to accompany them, the singers were thrilled. It was by far the largest orchestra they had had on the tour and one of the best in Germany. With a certain amount of trepidation, therefore, the chorus began singing

(Concluded on page 40)

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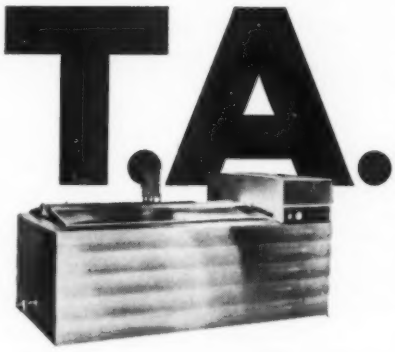

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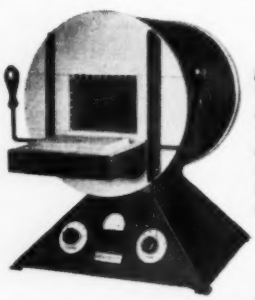

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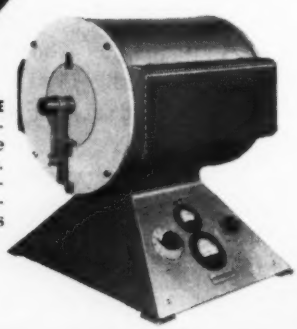

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CHORAL SOCIETY ON TOUR

(Concluded from page 38)

with them. The musicians at first seemed not particularly impressed and somewhat indifferent. Their expressions changed after hearing the choir's rendition of the Büchtger. But they applauded spontaneously when they heard the *a capella 67th Psalm* for eight parts by the American composer, Charles Ives. All signs pointed to a good concert.

The new auditorium of the *Residenz*, a former palace – now a partly bombed-out shell and partly rebuilt – was the scene of the concert. The Choral Society's performance was the finale of Munich's Choral Week, and the "Saturday-night" audience that turned out for it was sophisticated in both looks and musical taste. A threefold test faced the singers: orchestra, auditorium, and audience. They met the test and passed it in extraordinary fashion. From program to performance the concert was eminently successful. On Monday, July 28, 1958, the *Münchner Merkur* said: ". . . an unusual program from Bach to Büchtger – studded with difficult intonations – were some of the highlights of the evening." The chorus was particularly pleased with the following comment from the same review: "The most outstanding accomplishment, though, was Büchtger's chamber oratorio, *Die Auferstehung*. Liepmann succeeded in presenting the most impeccable performance of the work so far in regard to the chorus. By concentrating on pure vocal sounds he developed them into a shining transparency." And perhaps the best description of the M.I.T. Choral Society itself was that found in the *Süddeutsche Zeitung, München,* July 30, 1958: ". . . a thoroughly musical, eager chorus of laymen which has set high goals for itself and reaches these goals throughout."

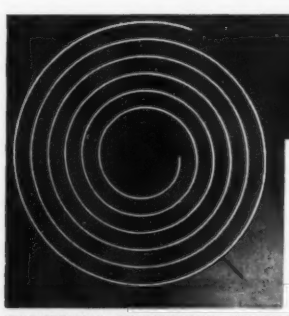
TREND OF AFFAIRS

(Continued from page 25)

their interest and poise throughout the season. The won- and loss-record of four and 12 does not indicate the ability and desire of the players who were in every ball game until late innings.

The leadership of Captain Robert W. Witte, '58, defensive ability of outfielder Eric H. Hasseltine,

(Continued on page 42)



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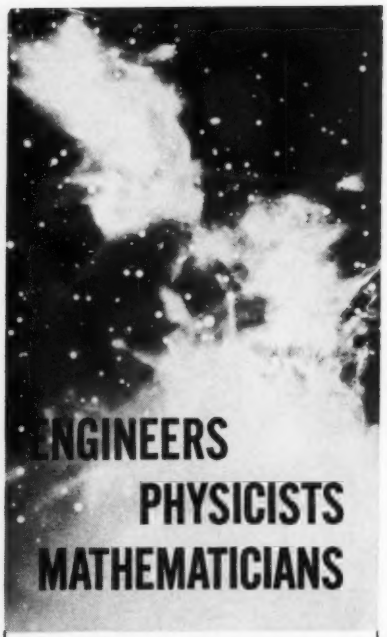

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TREND OF AFFAIRS

(Continued from page 40)

'59, Fulbright scholarship winner Robert J. Hecht, '58, and sophomore first baseman Neil P. Fitzpatrick, '60 – along with the enthusiasm and hustle of the team – provided the players and coach with an interesting and rewarding season.

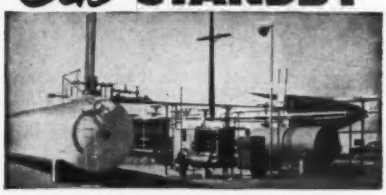
The outstanding manner in which Gerald J. Hornik, '60, carried out his varsity baseball managerial responsibilities, and the excellent leadership of the freshman baseball team by Coach Christy P. Emerson, a graduate student in the City Planning Department of the Institute's School of Architecture and Planning, deserve mention.

Basketball

Varsity – The team's record of five wins out of 20 games played could have been quite a bit better if we could discount two factors: namely, had five games lasted a minute or two longer; and had we had the services of Robert J. Polutchko, '59, for the first 10 games of the season. Five games were lost by three points or less. Polutchko, who was on Coop the first semester, in the last 10 games scored four fewer points than the teams' high scorer scored in 20 games. He also averaged 12 rebounds a game. Captain McClaran Jordan, '58, once again led in assists with 45. Eric H. Hasseltine, '59, came to Tech from Hamil-

(Continued on page 44)

GAS STANDBY



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TREND OF AFFAIRS

(Continued from page 42)

ton via the "three-two" plan and wound up third high scorer. Sophomore Herman N. Burton, '60, showed flashes of greatness and should have a much better year next year.

Coach Burke was tremendously impressed with the desire to win that was evident all season. No matter what the difference in the score, every Tech opponent could not relax for a moment in any given game.

Freshman – The 1957–1958 freshman basketball team paints a typical picture of the students representing M.I.T. in the intercollegiate program.

The initial call for basketball candidates resulted in try-outs by students who had prep school backgrounds from Egypt, Mexico, California, Texas, Illinois, Montana, Ohio, and 30 other scattered states. When the final roster was completed, there was only one team member from Massachusetts on the squad. The previous playing experience ranged from no experience in organized participation to a member of the Illinois State Championship Team. The "timber line" of the players ranged from 5'7" to 6'3".

Academically, the squad was typical of M.I.T. team squads with the average team term rating higher than the average team rating of the M.I.T. student. A

(Continued on page 46)

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TREND OF AFFAIRS

(Continued from page 44)

large majority of the squad members were interested in other extracurricular activities. The academic pressures, loyalty to the team, and freshman orientation adjustments presented personal decisions necessitating self-discipline and growth of the team members, which was evident during the progress of the season.

The steady and occasional outstanding play of Captain Philip J. Robinson, '61, and Brian E. White, '61, highlighted the individual play of the season's competition. The ability of the team to bounce back after defeats was the chief characteristic of the season's progress. The final game victory over Wesleyan was a fitting climax to a rewarding season both on and off the court.

Golf

The Tech golf team won four and lost six games. They had many individual matches go in their opponents' direction on the 18th hole. Had half of these gone to the Tech players they would have had a winning season. They won over Brown, Tufts, Worcester Polytechnic Institute, and Bowdoin. They lost close matches to Colby, New Hampshire, Harvard, and Wesleyan. Williams and Holy Cross were distinctly superior.

(Concluded on page 48)

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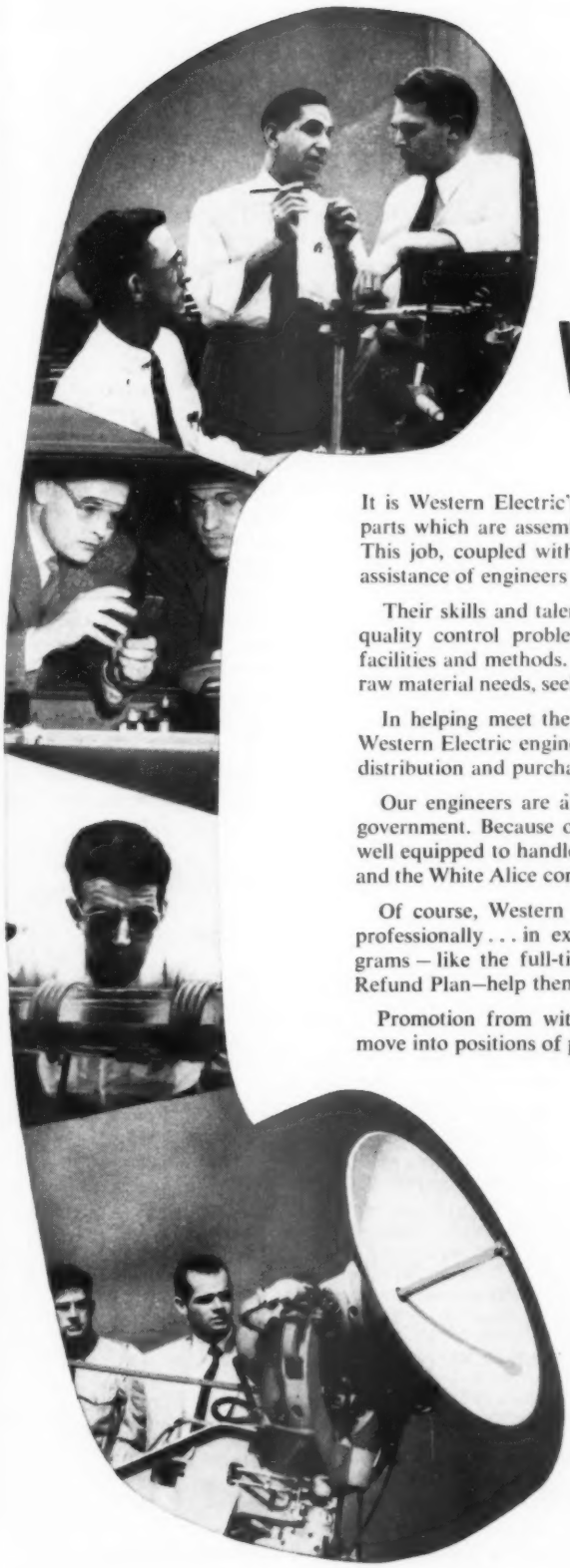

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Our engineers are also deeply involved in defense projects entrusted to us by the government. Because of our specialized experience as part of the Bell System we are well equipped to handle the job. Among these projects: the Nike guided missile system and the White Alice communications network in Alaska.

Of course, Western Electric engineers are encouraged and assisted in developing professionally . . . in expanding their technical know-how. Company-sponsored programs – like the full-time Graduate Engineering Training Program and the Tuition Refund Plan—help them along.

Promotion from within—a Western Electric policy—helps many of our engineers move into positions of prime responsibility. Today, 55% of the college graduates in our upper levels of management have engineering degrees. In the next ten years, 7,000 key jobs must be filled by newly promoted people—engineers included.

Western Electric technical fields include mechanical, electrical, chemical and civil engineering, plus the physical sciences. For more information pick up a copy of "Consider a Career at Western Electric" from your Placement Officer. Or write College Relations, Room 1111C, Western Electric Company, 195 Broadway, New York 7, N. Y. And sign up for a Western Electric interview when the Bell System Interviewing Team visits your campus.

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Random Vibration *by* *Stephen H. Crandall*

A set of notes written especially for engineers who are already familiar with classical vibration theory and who need an introduction to the random vibration problem which has become so important in recent years in the design and testing of missiles, jet aircraft, and other vehicles subject to random loadings. $10.00

The Inflationary Spiral: The Experience in China 1939-1950 *by Chang Kia-Ngau*

"Plainly Mr. Chang has written a book that ought to find its way into the hands of legislators and administration officials. . . . Certainly there is meat to be found for any American who is interested in why his own dollars buy less and less."—*The Wall Street Journal* $10.00

Soviet Education in Science and Technology *by Alexander Korol*

A description and evaluation of the Soviet educational system. The author's findings are directly related to current problems of American education and raise some important questions about American educational aims. $8.50

Order from

The Technology Press

Cambridge 39, Mass.

TREND OF AFFAIRS

(Concluded from page 46)

The bright spot of the season was Captain Robert L. Rosenfeld, '59, who won medalist honors in the New England Intercollegiate Golf Championships. Bob, in beating the field of 126, shot a 73 on a cold, wet, and windy day. During the regular season, Bob won decisions over every Number One opponent except the Holy Cross Number One man.

U. S. PROGRESS

(Continued from page 34)

tally, by the support of basic research we gain as an important by-product the advanced training of young scientists.

It is worth noting that during the hard times of the 1930's forward-looking technical industries increased their research efforts and this policy paid off.

Then, in order to protect the national economy, the important point is to exercise extreme care beforehand in planning for the costly development and the production which can emerge from among the possibilities identified by research. By careful selection of the developments and undertakings which have most promise and the highest priority, we contribute in considerable measure to the protection of a balanced national budget.

What has just been said in the area of science and technology seems capable of extension to our plan-

(Continued on page 50)

SPECIAL REPORT

Mr. HERBERT V. KIBRICK NEW YORK LIFE AGENT

at BOSTON GENERAL OFFICE

BORN: July 8, 1915.

EDUCATION: Harvard University, B.S., 1938; Harvard Graduate School of Business Administration, 1943.

MILITARY: U.S. Army Q.M.C.—First Lt. Sept. '43-June '46—U.S.Army Reserve T.C. (Active)—Major.

REMARKS: In or out of uniform, Herbert Kibrick is a man of many accomplishments. Entering the Army as a Private, he was released with the rank of Lieutenant and is now a Major in the Active Reserve. His record as a New York Life representative is equally impressive. Joining the Company on August 17, 1938, Herb Kibrick—whose father is also a New York Life representative—is today a member of New York Life's Presidents Council and a 1958 Qualifying and Life member of the industry-wide Million Dollar Round Table. In addition, his intense interest in life insurance led him to study for and earn the coveted designation of Chartered Life Underwriter. Herb Kibrick, vitally interested in his community's cultural and educational activities, has served on the staff of Northeastern University's School of Taxation and is a Director of both the Friends of Music, Boston University, and of the New England Alumni Association of Phillips Academy. Popular and personable, Herb Kibrick in every way exemplifies why "The New York Life Agent is a good man to know—and to be."

Note Herb Kibrick is established in a career as a New York Life representative that has provided him with security, substantial income and the deep satisfaction of helping others. If you'd like to know more about such a career for yourself with one of the world's leading insurance companies, write to the address below.

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We invite you to visit or write our Trust Department to learn how our methods of investment management can be of value to you.

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U. S. PROGRESS

(Continued from page 48)

ning as a nation. The question is whether, even under the most favorable circumstances, our economy is prepared to cope with the costs in effort and money required for the increasingly many and varied opportunities that lie before us. Speaking literally, this has never been possible. The new factor which has been entering the picture by degrees and is now prominent is that, as a nation, we shall have to pay even greater attention to our objectives and to the priorities among them.

This point is brought into sharp focus in connection with our present subject. There is an apparent lack of realization and determination on the part of our citizens to advance progress in education and in science. Without this realization and determination it is not possible to act with the promptness which is required. Although the facts have received much publicity and should be pretty generally known, it becomes increasingly clear that these do not at present appear truly to be national objectives, as understood by the people.

Perhaps what is missing is a clear conception on the part of our citizens of what our objectives are as a nation and more importantly how we can achieve them, and most important of all, what each citizen's responsibility is in co-operating. There would probably be found general agreement on our traditional

(Concluded on page 52)

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Scientists and engineers who can contribute to Vought's deep-water or deep-space projects are invited to write directly to A. L. Jarrett, Manager, Advanced Weapons Engineering, Department TR-2.

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U. S. PROGRESS

(Concluded from page 50)

objective of peace and prosperity—"the pursuit of happiness." However, we do not seem to understand that it will be impossible to maintain our own peace and prosperity unless we do and do promptly the things necessary to compete in a modern world. What is meant by this? Simply to develop our capabilities, both individually and collectively, to the fullest and then, in order to maintain a sound economy, identify and select the areas of endeavor which should engage our fullest attention in terms of money and effort. In science we should put maximum emphasis upon the relatively modest needs of basic research in order to learn all the possibilities of progress in technology and then choose carefully the fields for development that require large capital sums.

To be sure, a primary responsibility lies with the federal government to take the lead in the solution of these problems, but to provide full solution requires the understanding and the co-operation of all citizens. The responsibility of the federal government then is: (a) to insure that the problem is entirely understood by the people; (b) to provide direct support according to carefully devised plans; (c) to consider seriously ways and means of increasing substantially funds from other sources. The responsibility of the people is first to give these problems their careful attention and, second, to determine, as their government has to do, the degree to which they can contribute by thought, action, and money to our national goals as well as to the satisfaction of their personal needs and desires. In other words, each citizen should be fully and continuously aware of his active responsibilities to the nation and to its primary goals, in time of peace as well as war, and be prepared to make the necessary sacrifices to achieve them.

Whether our objectives as a nation are to deter our enemies, to achieve and maintain world leadership, to extend a helping hand to underdeveloped nations, or merely to maintain our peace and prosperity at home, the first essential is a real determination to achieve better education, better science and technology and, above all, the development of quality—quality in training and quality in performance. Unless we can succeed in accomplishing these things, we can maintain neither our national objectives nor the personal objectives of our people.

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Many have found our booklet "Will Making — the Chart of an Estate" helpful in planning the disposition of their estates. A copy will be mailed on request, without obligation.

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PRESIDENT'S ANNUAL REPORT

(Continued from page 32)

its first year of operation in June. Using its great digital computer (I.B.M. Type 704), the Center has furthered M.I.T.'s pioneering work in data processing, automation, and computation. It is almost impossible to suggest in brief the breadth of research which has been carried out at the Center. This research has covered both the physical and social sciences, ranging from numerical weather predictions to the machine translation of languages. The Center has also provided important educational opportunities: during the year, at least six academic departments have used the computer in their curricula.

New Facilities

During the year, the Institute moved forward with important additions to its resources for education and research.

Of prime importance is the $3,000,000 nuclear reactor, which "went critical" during the summer. The first privately owned heavy water reactor in the United States, it is one of the most versatile ever constructed for research and teaching purposes and will furnish nuclear particles and radioactive materials for research in medicine and industry, as well as in the basic sciences. By providing students with first-hand experience with fission energy, the reactor will be the chief laboratory facility of the Institute's new Department of Nuclear Engineering. It may well become a prime agency for the training of young men who will be leaders in developing the peacetime uses of atomic energy.

New athletic and recreational facilities will greatly strengthen the Institute's physical education program. Foremost in importance of the year's developments has been the start of construction of the David Flett du Pont Memorial Athletic Center on the West Campus. An $800,000 building, it will provide added space for intercollegiate sports, six squash courts, facilities for women, and a locker room for Faculty members. Twelve new tennis courts, which were an integral part of the bequest of David F. du Pont '56, have already been completed; and tennis, both in intercollegiate and in intramural competition, has become one of the popular athletic and recreational activities on the M.I.T. campus. With the acquisition and renovation of the Cambridge Armory on Massachusetts Avenue, the Institute has achieved, for the first time in its history, adequate gymnasium space for intramural sports. The old drill floor alone has provided two indoor tennis courts, eight badminton courts, and four volleyball courts.

New quarters for the religious counselors of the Institute were provided with the acquisition of a private dwelling at 317 Memorial Drive. This attractive house, with adequate provision for seminar facilities and located in the dormitory area adjacent to the Chapel, has given a physical unity and strong stimulus to our religious counseling program.

Sponsored Research

The Institute has always accepted sponsored research projects as an integral part of its educational system.

(Continued on page 56)

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Laminated Synthetic High Voltage, small diameter cables are made by multi-wrapping the conductor with synthetic tapes which are coated with insulating fluid. This technique produces cables with high corona levels that have long life under high dielectric stress. These cables are particularly desirable for application at high altitudes. The fluid protects the insulating tapes, excludes the air which would normally pocket between tape layers, and fills cavities around solid or stranded conductors. BIW LSHV cables thus provide the highest levels of corona extinction for small diameter cables.

A few of the present uses are for tube-cap leads, high voltage electron precipitators and for laboratory electrical test equipment. BIW cables find new uses every day. 50,000 volt cables are now in design. Temperature rating up to 125° C.

BIW TYPE	SIZE AWG	O.D. CABLE	VOLTAGE RATING
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LSHV-15,000-18	18	.275	15,000
LSHV-17,000-14	14	.300	17,000
LSHV-20,000-10	10	.320	20,000
LSHV-25,000-12	12	.400	25,000
LSHV-30,000-14	14	.550	30,000
LSHV-30,000-10	10	.550	30,000

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WALLACE J. FLYNN and family live in Arlington, Massachusetts. In addition to his business and family life, Flynn has scouted for the Harvard football team on which he once played. With him are his sons and his wife, the former Nancy L. Gillmore. (Reprinted by courtesy of the Boston Herald.)

THE BOSTON HERALD, MONDAY, MAR. 17, 1958

$456 Billion Beckons Go-Getters

Life Insurance Big Selling Job

(Business is more than the action within executive suites. It is the sum total of hundreds of skills and professions which build and operate the $440 billion U. S. economy. This is the first of a continuing series of Herald articles on various jobs and the persons behind them. They will appear on successive Mondays.)

By JUAN CAMERON

One day last winter Boston insurance salesman Wallace J. Flynn went to work on a friend who stated flatly he "didn't believe in life insurance." Several meetings later Flynn signed up his disbelieving friend on a $40,000 life policy with an annual premium of $1000.

Such efforts of the 33-year-old Flynn [illegible] thousands other insurance [illegible]

New England Life agent subject of feature article

To lead off his fine series of articles on various occupations, Juan Cameron of *The Boston Herald* focused on the accomplishments of Wallace J. Flynn.

Wally's been with New England Life four years — an agent with the Hays Agency of Boston. Previously he had held a good position in another field: merchandising manager of a large textile company. He is a graduate of Harvard (class of '46) and was an outstanding member of three varsity football and baseball teams. His college course was interrupted by service as a Navy torpedo plane pilot.

Why did he choose to go to work for New England Life? "I like the career opportunities of life insurance selling," Wally explains. "I now have control over my own time . . . I'm sure of getting rewards in direct proportion to my efforts . . . and I feel good about the complete cooperation I get from my company."

Perhaps a career of this sort appeals to you. There are opportunities at New England Life for other ambitious college men who meet our requirements. You get income while you're learning. You can work anywhere in the U.S.A. Your future is full of substantial rewards.

You can easily get more information by writing to Vice President L. M. Huppeler, 501 Boylston Street, Boston 17, Massachusetts.

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Arthur C. Kenison, '19, Boston

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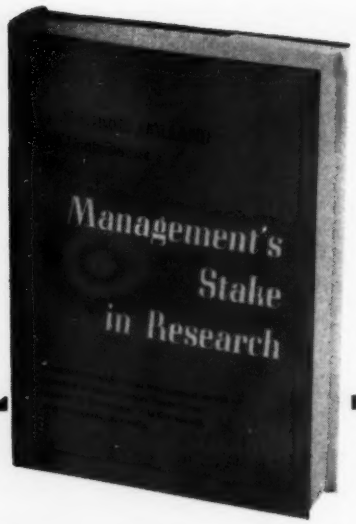

What research means to industry today

Management's Stake in Research

By MAURICE HOLLAND

and Contributors

■ A distinguished management consultant has brought together a group of authorities to define the role of research in today's industrial complex: what management should expect of it, how to gear it to marketing problems, how to organize, budget, and finance it, and how to appraise its results. Special attention is given throughout to the needs of small companies and to the role of basic research.

This broad evaluation of research as an essential tool of management will serve and inform executives of industrial companies, marketing specialists, teachers and students of business administration, and research technicians who want to understand the interrelations of their work and overall company policy.

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PRESIDENT'S ANNUAL REPORT

(Continued from page 54)

Such work, whether in the campus or in the defense laboratories, provides unusual opportunities for both graduate students and Faculty to participate in research at the frontiers of their respective fields. We recognize also that urgent demands will be made upon our resources in times, such as the present, when the safety and strength of the free world depend so greatly on advanced science and technology. Such responsibilities we continue to accept on a selective basis, when the work is in fields in which the Institute has particular competence and which will benefit our educational mission.

A major organizational move during the year, designed to promote this trend, has been the co-operative effort of M.I.T. and the Department of Defense in the formation of Mitre, a new independent, nonprofit corporation to undertake a major advisory role in the systems engineering of the country's air defense. Much of this responsibility, relating to the electronic ground environment of air defense, has previously rested on the Lincoln Laboratory. One objective of this organizational move is to permit the Lincoln Laboratory to devote more of its time to the type of advanced research which fits most naturally and productively into the scheme of an educational institution.

It seems imperative, however, that some form of long-term funding of government-sponsored research programs be adopted with ample warning of termination. The present system of funding on an annual basis is not suitable for colleges and universities where educational programs are of necessity arranged by academic terms. If there is to continue an urgent need for academic contributions to defense research, then surely there is an equally urgent need for review of this problem by the government itself.

The past year, reflecting the state of national need, has witnessed an increase both in cash expenditures and in numbers of staff personnel for our research projects. However, the Acoustics Laboratory and the Dynamic Analysis and Control Laboratory were disbanded during the year as administrative units, although several of their programs of research have been continued in academic department projects.

The Instrumentation Laboratory of the Department of Aeronautical Engineering, moving steadily into the "space age," accelerated its research and development work in guidance and controls systems for satellites and ballistic missiles, including the Navy's "Polaris." An important contribution has been the development of devices for inertial navigation by submarines on extended underwater cruises. Such systems have special importance for operation under the polar ice cap where

(Continued on page 58)

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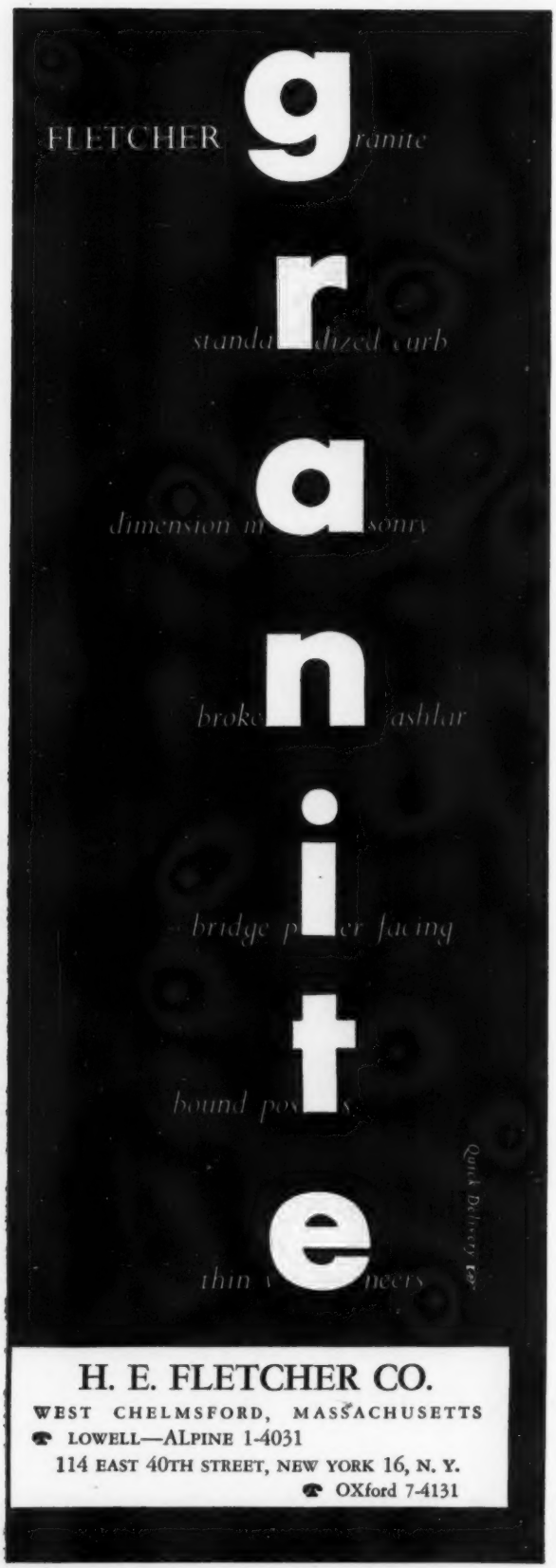

PRESIDENT'S ANNUAL REPORT

(Continued from page 56)

magnetic readings are extremely ineffective. Under the leadership of Professor Charles S. Draper, '26, Director of the Laboratory, a major and vigorous basic research program is being undertaken on the future needs of astronautical navigation.

At the Lincoln Laboratory, the year was marked by significant new advances in fundamental research and by substantial progress in the development of the SAGE [Semi-Automatic Ground Environment] System and in other extensions of air defense technology. Existence of two kinds of excitations in germanium have been accurately determined for the first time, using infrared measuring techniques and powerful magnetic fields. Such information may well serve to open up a new solid state spectroscopy.

The first full sector of the SAGE System for air defense of the continental United States went into operation in June, 1958, for the improved protection of the New York-Philadelphia area. By far the largest information processing and control system ever attempted, SAGE utilizes a network of large digital computers teamed with skilled operators to sift out potentially hostile aircraft from tens of thousands of daily routine flights and to direct interceptors and missiles against the enemy. Initially proposed by Lincoln in 1953 on the basis of previous studies at M.I.T., the development of this system has been a major activity of the Laboratory in the intervening years.

This is but a sampling of the many developments coming out of our large industrial and government-sponsored research laboratories.

A Statistical Abstract

In 1957-1958 the student body numbered 6,179 as compared with 6,000 in 1956-1957. We estimate that enrollment this fall will be about 6,200. Veterans numbered about 6 per cent of the total enrollment as compared with 8 per cent the year before. In 1957-1958, 21 per cent of our students were married, an increase of 3 per cent over the previous year. One hundred and twenty-two women were enrolled, 59 of whom were graduate students.

Enrollment in the Graduate School was 2,515. There were 140 officers from the United States armed services enrolled for advanced degrees.

Students enrolled at M.I.T. during 1957-1958 held degrees from 484 other colleges and universities, 297 American and 187 foreign. Total foreign student population was 732, representing about 12 per cent of the total student body. These were citizens from 68 different countries.

Student Aid

Total financial assistance given to M.I.T. students last year amounted to slightly more than $2,400,000, an increase of 15 per cent over the previous year. This increment was due to the cumulative effect of several important factors, including gifts and bequests from Alumni and friends and the use of Institute funds to meet special demands.

Financial assistance to undergraduates totaled nearly $1,600,000, bettering by some $200,000 the recorded help for the previous year. Specifically, $710,530 was granted in scholarships; $397,087 in loans; and $482,000 earned in part-time employment around the campus.

(Continued on page 60)

GRAHAM H. BLAKE, an ex-automobile salesman, was only 22 when he joined the Massachusetts Mutual Agency at Barre, Vermont. 1957 sales: $805,350.

JOSEPH E. ROCK, 24 when he joined our Boston-Robertson Agency was formerly assistant manager for a finance company. 1957 sales: $1,226,100.

CHARLES E. MITCHELL joined our San Antonio Agency following military service; former grain inspector and accountant. 1957 sales: $664,113.

PHILIP G. GALLANT, an attorney, practiced international law before becoming a member of our Spokane Agency. 1957 sales: $910,500.

TREVOR D. WEISS was a successful women's wear merchant before he joined our Chicago-Geist Agency. His 1957 sales: $958,600.

A new career pays off for these men

These men who joined the Massachusetts Mutual in 1956-1957 proved that life insurance selling can pay off—fast and profitably.

• These five men are typical of the men joining our field force each year—enthusiastic men with varied training and business experience—men who make the most of the outstanding opportunities and facilities which Massachusetts Mutual offers.

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Does your present position offer comparable opportunity? Maybe you too should investigate the potential of life insurance salesmanship with our company—one of the oldest and strongest in the country.

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PRESIDENT'S ANNUAL REPORT

(Continued from page 58)

At the same time, financial support to our graduate students showed only a slight increase over the record amount given in 1956-1957. In all, the Institute awarded 206 fellowships totaling $385,988 and 93 scholarships valued at $126,987. Loan funds assisted 203 students to its amount of $113,112. Including staff awards for teaching and research, grants last year totaled $813,839.

It is gratifying to note that at the close of the fiscal year (June 30, 1958) the capital of the undergraduate scholarship funds totaled $5,425,000, an increase of almost $400,000 or 8 per cent over a year ago. This growth resulted from some 20 bequests and gifts including new capital funds from Evert W. Freeman, '20, Humphrey M. Haley,'04, Bancroft Hill, '11, William W. Stevens, '98, Archer E. Wheeler, '95, George H. Rand, and Gustaf R. Lindberg. Additional gifts to previously established permanent funds were made by Paul W. Litchfield, '96, and John J. Wilson, '29.

During the past decade, the total of our endowment for scholarships has doubled and so has apparently kept pace with changes in tuition. But because of increases in the size of the undergraduate body, the incremental gain in both capital and income has not kept up with demands for assistance. At the present time we are assisting through scholarship aid only 22 per cent of our undergraduates, a percentage relatively low compared to other ranking educational institutions. Our need for augmented scholarship endowment funds is urgent.

The concern for scholarship aid should not overshadow the substantial help made available by our loan fund program, which is one of the most successful and probably the largest administered by any educational institution. Each year, increasing demands are made upon our loan resources. Last year, for the first time in nearly

(Concluded on page 62)

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It would be desirable if you were familiar with present applications and future potentialities of transistors and diodes, in order to contribute actively to the general policy of the new firm.
Salary will be commensurate with experience and ability. Transportation and moving expenses will be paid.
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Please write, enclosing detailed resume, to Project T.D.L., Olivetti, Ivrea, Italy.

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PRESIDENT'S ANNUAL REPORT

(Concluded from page 60)

30 years of operation, we loaned a total exceeding the half-million dollar mark. Specifically, loans totaling $510,919 were made to 662 individuals representing 13 per cent of the entire student body.

Administrative changes effective July 1, 1958, will serve to strengthen the program and meet the increasing demands by accelerating the rate of rotation of capital funds and insuring the complete repayment of maximum amount loaned within a 20-year period. At the same time —for the first time in its history—our loan fund becomes available to entering freshmen.

Gifts

Gifts during the past year totaled $7,732,000, a decrease of $766,000 from the amount received in 1956-1957. Of this total, gifts for endowment purposes amounted to $1,138,000, including substantial bequests from the estates of Frank Hanchett and Hazel Hanchett Harvey for the Walter R. Hanchett Fund, and a sum of $145,000 from Archer E. Wheeler, '95, for a scholarship fund.

The Donner Foundation of Philadelphia generously awarded the Institute a grant of $500,000 to establish an endowed professorship in natural science. Dr. Claude E. Shannon, '40, of the Departments of Electrical Engineering and Mathematics has been appointed the first holder of the Donner Chair of Science.

By the end of the academic year the Institute completed its intensive drive for funds to increase Faculty salaries. The Sloan Foundation, backed by the generous assistance of Alfred P. Sloan, Jr., '95, had offered a grant of $1,250,000 towards a $5,000,000 fund for Faculty salaries, provided the Institute obtain the remaining $3,750,000 from other sources. A countless number of Alumni and friends of the Institute contributed generously to the fund, enabling us to reach the goal.

Alumni were directly responsible for gifts to the Institute of $2,452,000 during the past year. Over 13,000 individuals contributed $445,194 to the Alumni Fund for further designation by its Fund Board.

Corporate support of the Industrial Liaison Program totaled $1,188,000, as given by 90 different companies. It is very heartening to receive such generous support in spite of the generally unfavorable economic outlook that has prevailed throughout the past few months.

In addition to this condensation of Dr. Stratton's inspiring report, The Review plans to summarize the Institute's financial operations in an early issue.

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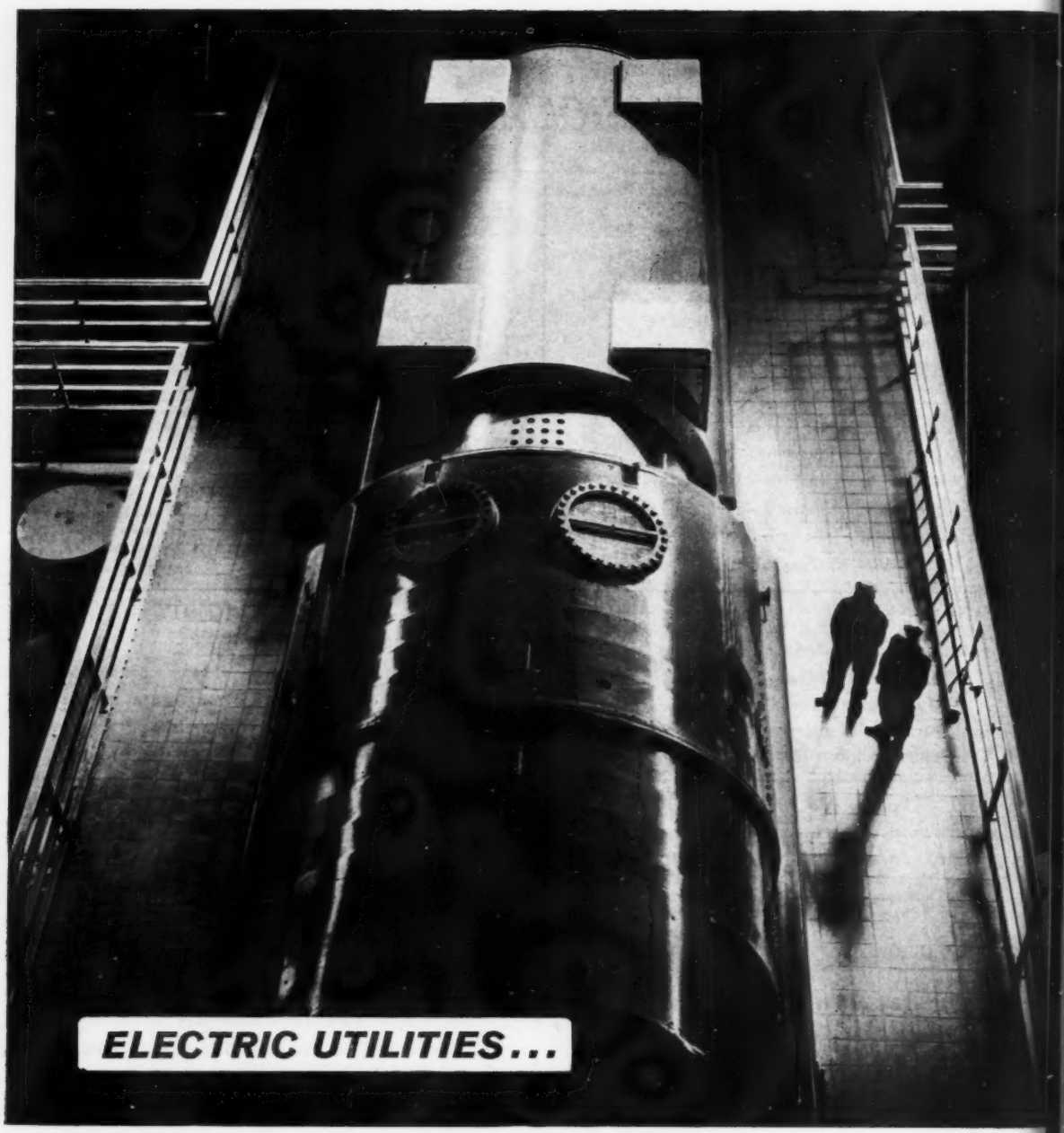

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	W20 Uncased	W20M Cased	W20MT3 Portable	W20H Uncased	W20HM Cased	W20HMT3 Portable
Input Voltage	115	115	115	230	230	230
Load Rating (kva)	2.0	2.0		2.4	2.4	
Output Voltage	0-135	0-135	0-135	0-270	0-270	0-270
Rated Current (amp)	20	20	20	8	8	8
Maximum Current (amp)*	26	26	20	10.4	10.4	8
No-Load Loss at 60c. (w)	27	27	27	27	27	27
Dial Calibrations†	0-115 0-135	0-115 0-135	0-135	0-230 0-270	0-230 0-270	0-270
Angle of Rotation (deg.)	320	320	320	320	320	320
No. Turns on Winding	170	170	170	340	340	340
D-C Resistance of Winding (±)	0.21	0.21	0.21	1.6	1.6	1.6
Driving Torque (oz.-in.)	55-110	55-110	55-110	55-110	55-110	55-110
Net Weight (lbs.)	21½	24½	28½	20½	23½	27
Code Word	FEDAL	FEDER	FEDOM	MEPAL	MEPER	MEPOM
Price	**$45.00**	**$58.00**	**$87.00**	**$47.00**	**$60.00**	**$85.00**

*For "0 to line voltage" connection only.

†Portable (MT3 and HMT3) models are wired for over-voltage connections and have corresponding dial scales. Line voltage connections and dials supplied on special order.

Types W20 and W20H Variacs are approved by the Underwriters' Laboratories.

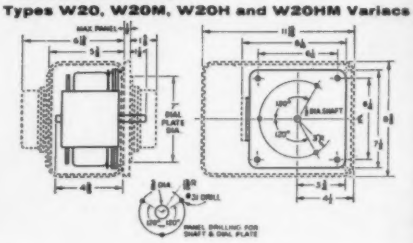
All Type W20 Variacs can be supplied with ball bearings. Add suffix BB to type number, and following surcharge to prices: — Single, $8.00; 2 gang, $10.00; 3-gang, $12.00.

Replacement Brushes — W20, W20M, W20MT3 = Type VBT-8, $2.00. W20H, W20HM, W20HMT3 = Type VBT-12, $2.00

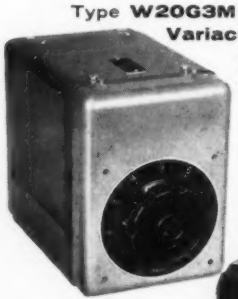
Type W20 Variac
115-Volt Input; 3 KVA; 26 Amp. Max. Current
(W20H similar except for terminals and dial)

For back-of-panel use on switchboards or built into other equipment. Also usable on table or bench.

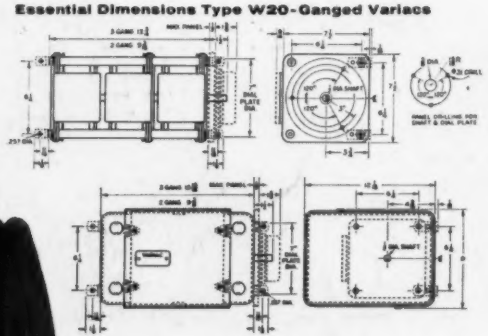
Essential Dimensions
Types W20, W20M, W20H and W20HM Variacs

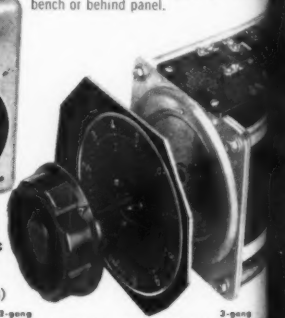


Type W20G3M Variac Cased Model in aluminum case, gray enamel finish. Two knockouts on end and one on each side for conduit or armored cable. Front half of case easily removed. Simple to install on wall, bench or behind panel.



Essential Dimensions Type W20-Ganged Variacs





Type W20G2 Variac
2-Gang Type W20
(W20HG2 similar except for terminals)

	2-gang W20G2 Uncased			W20G2M Cased	3-gang W20G3 Uncased		W30G3M Cased	3-gang W20HG3 Uncased			W20HG2M Cased	3-gang W30HG3 Uncased		
Input Voltage	115	115	230	Same as W20G2	115	230	Same as W20G3	230	330	460	Same as W30HG2	230	460	
Load Rating (kva)	6 (parallel)	5.2 (Delta)	6 (Series)	Same as W20G2	9 (Parallel)	10.4 ("Y")	Same as W20G3	4.8 (Parallel)	4.2 (Delta)	4.8 (Series)	Same as W30HG2	7.2 (Parallel)	8.3 ("Y")	
Dial Calibrations	0-10			0-10	0-10		0-10	0-10			0-10	0-10		
Driving Torque (oz.-in.)	110-220			110-220	165-330		165-330	110-220			110-220	165-330		
Net Weight (lbs.)	43½			48	64½		71	41			45	61		
Code Word	FEDAL GANDU			FEDAL BONDU	FEDAL GANTY		FEDAL BONTY	MEPAL GANDU			MEPAL BONDU	MEPAL GANTY		
Price	**$100.00**			**$125.00**	**$147.00**		**$175.00**	**$104.00**			**$129.00**	**$153.00**		

Type W20MT3 Variac
(Type W20HMT3 similar except for dial) NEW Portable Model, cased, 3-wire output receptacle, ON-OFF switch, overload circuit breaker, heavy-duty 3-wire line cord and plug.

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